

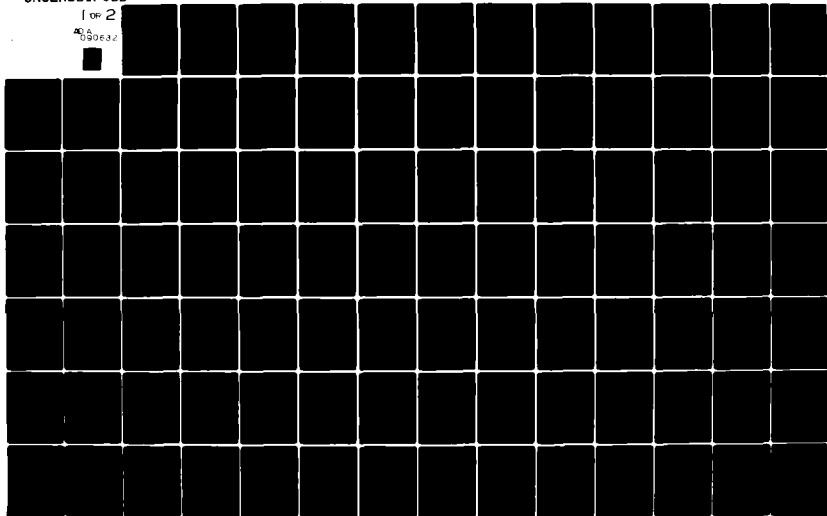
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QUALITATIVE MAINTENANCE EXPERIENCE HANDBOOK

P-3C/S-3A SUPPLEMENT

VOUGHT CORPORATION
DALLAS, TEXAS

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Prepared for
MAINTENANCE POLICY AND ENGINEERING DIVISION
Naval Air Systems Command
Washington, D.C. 20361

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
	AD-A090632	
4. TITLE (and Subtitle)		5. TYPE OF REPORT & PERIOD COVERED
QUALITATIVE MAINTENANCE EXPERIENCE HANDBOOK, P-3C/S-3A SUPPLEMENT		FINAL REPORT JANUARY, 1975 - JUNE, 1976
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER
Kenneth Ira/Webman Donald/Duperre		
9. PERFORMING ORGANIZATION NAME AND ADDRESS		8. CONTRACT OR GRANT NUMBER(s)
VOUGHT CORPORATION MAINTAINABILITY ENGINEERING P.O. BOX 5907 DALLAS, TEXAS 75222		N00140-76-C-0025/ Sub-task LTV-7T-26
11. CONTROLLING OFFICE NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
NAVAL AIR SYSTEMS COMMAND AIR-4114 WASHINGTON, D. C. 20361		
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE
12-1-6		15 JUNE 1977
		13. NUMBER OF PAGES
		15. SECURITY CLASS. (of this report)
		UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report)		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
MAINTAINABILITY, MAINTENANCE, HANDBOOKS, AIRCRAFT, MAINTAINABILITY INSTALLATION DESIGN, EQUIPMENT REMOVAL/REPLACEMENT, COMPONENT ACCESS		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)		
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ABSTRACT

The *Qualitative Maintenance Experience Handbook* presents an assessment of the qualitative maintainability features of selected component installations in Navy fighter and attack airplanes. This supplement makes the same assessment for the Navy/Lockheed P-3C and the Navy/Lockheed S-3A patrol and search aircraft. Rather than being an evaluation of the different airplanes, this survey identifies desirable and undesirable maintainability/maintenance significant features evident in the various installations of the same functional component. In essence, it offers an opportunity to review the design treatment of components with significant maintenance histories. This aggregate of experience gained over a spectrum of designs and a broad span of years can be used when making decisions concerning future designs of similar components. This handbook documents the qualitative impact of installation design on the person who must maintain the airplane.

PREFACE

This report was prepared by The Vought Corporation, Maintainability Engineering Group, Logistics Engineering Section, Dallas, Texas. The project was conducted under contract N00140-76-C-0025 and was monitored by Naval Air Systems Command, Aircraft Structures and Equipment Branch, AIR-4114, with Mr. George J. Donovan and Mr. Gerald R. Barlow as coordinators.

Principle analysts for Vought Corporation were Mr. Donald Duperre and Mr. Kenneth I. Webman.

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INTRODUCTION

The *Qualitative Maintenance Experience Handbook* presents an assessment of the qualitative maintainability features of selected component installations in Navy fighter and attack airplanes. This supplement makes the same assessment for the Navy/Lockheed P-3C and the Navy/Lockheed S-3A patrol and search aircraft. Rather than being an evaluation of the different airplanes, this survey identifies desirable and undesirable maintainability/maintenance significant features evident in the various installations of the same functional component. In essence, it offers an opportunity to review the design treatment of components with significant maintenance histories. This aggregate of experience gained over a spectrum of designs and a broad span of years can be used when making decisions concerning future designs of similar components. It represents the qualitative impact of installation design on the person who must maintain the airplane.

The handbook addresses only the qualitative assessment of each component. No quantitative factors such as failure frequency have been considered. Rather than acknowledging installation trade-offs routinely made on the basis of maintenance frequency, the observers evaluated each component as if they were to replace all the components in the airplane one time.

The components reviewed were limited to those functional items that had demonstrated significant maintenance burdens in the past. This addition to the initial fighter/attack survey was limited to S-3A and P-3C airplanes.

• IDENTIFICATION OF CANDIDATE COMPONENTS:

Maintenance data from the 3M Maintenance Data Collection System was collected for the period January, 1975 through June, 1976. This data was sorted against two parameters: frequency of maintenance and elapsed maintenance time. The top 80% of the total frequency or time was judged to be significant and, therefore, primary contributors to overall maintenance manpower costs. A total of 78 components met the criteria of this portion of the screening. Some of these items could not be evaluated adequately because of the configuration of the aircraft available at the survey site. These items, including engines, engine mounted accessories and components, and ordnance items were omitted.

The last step in the selection process was to compare those items surveyed in the initial *Qualitative Maintenance Experience Handbook*, on fighter-attack airplanes, to the maintenance significant candidate list for the P-3C/S-3A Supplement. The final candidate list of 100 components represents a compromise of those P-3C/S-3A maintenance significant items and items previously surveyed in order to retain continuity between this supplement and the predecessor volume. Efforts were made to look at like components on both the P-3C and S-3A even if only one aircraft had a significant problem. This enabled the observers to evaluate objectively why one installation appeared better than the other.

• SITE SELECTION:

The survey was conducted primarily at Naval Air Rework Facility (NARF) Alameda. NARF was selected as the primary site of the survey because the airplane panels are normally open for rework and the survey could be conducted with negligible disruption of maintenance. The complete survey could not have been conducted in an operational unit without considerable impact on the organization's operational stature. Procedures and schedules at NARF were such that some post-installation checkout data could not be obtained. This missing data subsequently was obtained along with information on squadron problems during a supplemental survey at operational squadrons stationed at NAS Cecil Field and NAS Jacksonville.

• **CONDUCT OF THE PROGRAM:**

A team of two contractor employees visited NARF Alameda and received assistance from appropriate NARF personnel. The NARF personnel located components for the team and provided technical information. Observations were made at the airplanes in the rework facility.

Each component was viewed in its location, if possible, with adjacent components installed. If no aircraft with the equipment installed was available, the mounting space and equipment were viewed separately. Removal tasks were described by knowledgeable NARF technicians. Since these tasks were merely to define the scope of work, no attempt was made to verify the descriptions with procedures contained in the manual. The team was interested in the effort that was involved in each task and the problems presented to the mechanic. In those instances where personnel were not certain of component maintenance procedures, the publications had to be consulted.

Individual data sheets were initiated for each component observed. Each data sheet includes an analyst's opinion which is a consensus of the team members. These opinions reflect an evaluation of the installation, specific good or bad points considered relevant, and occasional additional information related to the equipment but not described in the body of the form. The data sheets are included in the handbook.

During the NAS Cecil Field and NAS Jacksonville visits, discussions were held with maintenance personnel from two deploying wing maintenance staffs and four operational squadrons. Information was obtained on functional checks and problems personnel had in performing maintenance.

• **ARRANGEMENT OF THE HANDBOOK:**

The basic information item in the handbook is the component analysis. This consists of a package of individual component data sheets for a system and a summary sheet with a brief overview and descriptions of desirable and undesirable features found. It must be recognized that the summary is not a grade sheet, and the balance between desirable or undesirable features does not indicate the relative merits of the component installation. An acceptable installation actually rates no comment unless it has an unusually meritorious feature. Undesirable features are identified for even acceptable installations. It will be normal, then, that undesirable features will outnumber desirable features. Identification of aircraft in the summaries is made only to describe the installation. Each summary is located at the beginning of a system package. The component data sheets follow.

Comments, desirable and undesirable, and general recommendations made for components evaluated on the Navy fighter and attack aircraft and presented in the initial *Qualitative Maintenance Experience Handbook*, are to be considered as being applicable to the P-3C and S-3A components evaluated herein. Likewise, information presented in this supplement is applicable to the parent volume.

The team photographed many of the component installations or installation areas. These photographs were used in preparation of the text and for a single documented copy of the text with photographs for the procuring Navy office. The photo identification numbers appearing on the component data sheets correspond to this set of photographs.

The system packages are arranged in mechanical and avionic systems groupings to facilitate use. The systems are tabbed for convenience.

• **TERMS USED IN THE HANDBOOK:**

Generally, the terms used are those supplied by the technicians who assisted in the program. Unless a term was otherwise inappropriate or confusing, it was not necessarily translated into standard or generic terms.

• **GENERAL COMMENTS:**

The evaluating team deems it necessary to comment upon several areas of general concern. The mission profiles of the P-3C and S-3A necessitated a substantially larger airplane. The increased aircraft size has a major impact on the ease of performing maintenance, especially in avionics. The greater majority of avionics equipment is installed in internal racks characterized by outstanding working room and access. This is also true for some mechanical components which are mounted in large compartments. This was not the case during discussions of similar components packaged into small bays on fighter-attack airplanes. As such the reader in comparing functionally similar component installations between this supplement and the original volume must keep in mind the larger size of the P-3C and S-3A has enabled designers to optimize many installations. Although the component installations may be optimized, the relative merits and pitfalls described herein are applicable to all surveyed airplanes.

Many of the S-3A maintenance actions require the technicians to open (pull) circuit breakers as a safeguard to personnel and equipment. In some installations the list of circuit breakers and cockpit tagging operations is extensive and time consuming. Although disconnection of power from the main electrical busses is essential to preserve certain equipment and promote safety, the team believes that equipment should be designed to be turned on or off frequently without damage, and that, whenever possible, electrical on/off switches should be installed adjacent to the equipment to facilitate and ensure disruption of electrical power when necessary.

On several occasions, the team had to consult microfilmed copies of the maintenance manuals because of information voids. The S-3A MIARS (Maintenance Information Automated Retrieval System) microfilm was easy to read and to find component information. On the other hand, the P-3 MIARS microfilm was hard to read (density and contrast poor) and occasionally was puzzling on information location. This book concerns itself primarily with the relative aspects of good component installations. The ability to locate and read technical data is secondary. However, the ability of the technician to perform a job is directly impacted by the availability of useable maintenance instructions and as such is considered a part of any remove and replace task.

MECHANICAL

SYSTEMS

AIRFRAME/COCKPIT SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Radome	11123	11124
Ejection Seats/Pilots-Copilots Seat	12113	12111
Main Entrance Door	11228	1113A
Bomb Bay Door Actuator	1152A	11211

SYSTEM: AIRFRAME/COCKPIT

• *GENERAL COMMENTS:*

To make an objective comparison of airframe components from the standpoint of maintenance experience or maintainability without commenting on the S-3A fastening system would be a grave injustice. The S-3A makes extensive use of the High-Torque fastener. This fastener, specified for use on the S-3A in its detailed specification, is characterized by a slotted head which tapers at the center. Although maximum effort was made to standardize all exterior screws, which is a strong maintainability feature, High-Torque screws have proven to be a maintenance burden. The design of the slot in the head is such that a small amount of clearance must be allowed for the screwdriver. With use, the screwdriver wallows out the slot to the point that it can no longer be gripped thereby requiring the screw to be drilled out. Squadron personnel indicated that, if they were able to get five remove and replace actions on a single screw they were fortunate. This is most unsatisfactory, especially in areas of frequent maintenance. From discussions with NARF and squadron personnel the amount of resources being wasted drilling out so many screws is enormous. Designs and design specifications should not specify this type of screw except in areas which are predicted to have very high reliability and very low maintenance rates and, even then, Torque-Set screws would be preferred.

On the plus side of the S-3A fastening ledger is an outstanding quick-release latch. The latch has two round holes. One hole is about an inch and a quarter in diameter and opens the latch when pressed with a finger. The second, about one-half inch in diameter, and closes the latch. The latch is easy to operate and requires no tools. NARF Engineering personnel indicate the sole drawback is that the latch, because of low spring forces, may be susceptible to accidental opening by aerodynamic loading.

• *RADOMES:*

Radome removal on both aircraft is straightforward with access room to all bolts more than adequate. The radomes are necessarily large and awkward to maneuver. The P-3C radome required a stand upon a stand to reach the hinge points because of its height and the limited vertical space available with the radar dish installed. Springs in the radome latch are easily undone and become lost, requiring latch replacement. This maintenance irritant can be avoided easily by ensuring good latch design. The S-3A radome spares come with the attachment latches separate. Radomes should be designed interchangeable and should not require squadron assembly of latches.

• *EJECTION SEATS/PILOTS-COPILOT SEATS:*

The seats in these two airplanes differ radically. The (S-3A) seat is designed to be ejected while the P-3C seat is not. Very little can be said about the P-3C pilots/copilots seat. It is a very good installation and easy to remove and replace. The S-3A seats overall are very good installations for ejection seats. Disconnections are minimized and mountings are simple. The undesirable feature of this installation is the need to remove the canopy hatches to remove the seats. More than 133 High-Torque screws hold the hatch down. Designers should avoid the use of so many attachment fasteners or provide for an alternate means to remove and replace the seats.

• *MAIN ENTRANCE DOORS:*

Personnel enter the airplanes through doorways. The S-3A entrance door resembles a hatch with steps more than a conventional door. Both doors are easy to work on and remove and install simply. The S-3A door has problems with maintaining tension on the cable which assists the aircrew in opening and closing the door. The weight of the P-3C door creates minor problems when inserting bushings during installation. Extensive use of plastic kick panels on doors, as in the P-3C, should be avoided unless a highly durable plastic is utilized.

• **BOMB BAY DOOR ACTUATORS:**

Bomb bay door actuators in these aircraft differ in the manner in which they utilize their power sources. The S-3A uses a hydraulically operated actuator with an electric motor backup and is an outstanding design. The strongest feature is the use of spring loaded flex drives to mount to the actuator splines. It is a design worth emulating. The P-3C uses a conventional hydraulic actuator system consisting of four actuators, all easy to remove and replace.

• **ADDITIONAL COMMENTS:**

The initial screening process for candidate components identified avionics racks on the P-3C as a maintenance problem area. As such the team evaluated the rack removal and installation procedures with NARF and squadron personnel. The technician interviews indicated that the racks themselves on both airplanes do not require any substantial amount of work. When extensive work is required it is part of a modification effort accomplished by a "mod" team. This fact was the deciding factor for not including individual data sheets on avionic racks in this volume. However, some discussion should be addressed to the P-3C avionics rack doors, the reason the rack appears as a maintenance problem, and the S-3A hold down and extractor units used for holding in avionics boxes.

The P-3C avionics racks use doors made of honeycomb and fiberglass to save weight. Very frequently these doors become dinged (screwdrivers, casual abuse) and need repair. Repair must be done locally and is time consuming. The problem is more induced maintenance than a design problem. None the less, repair is time consuming. Designers should strive to design light weight doors and panels which preclude damages caused by careless handling. The current fiberglass repair kit includes a putty which dries like "rock". It is very hard to sand smooth to obtain a neat appearance. One squadron is using automotive putty, "Bondo," which is much easier to sand and requires considerably less time to affect repairs.

The S-3A avionics racks use a hold down and extractor unit to hold peculiar, non-GFE, S-3A "black boxes". This is an excellent retention system. The knobs are large enough to handle comfortably; some of the units have an indicator which disappears when the unit has reached its maximum tightness; and, they have a simple locking mechanism which requires no lockwire or tools. The only drawback is the requirement to tighten simultaneously the units on a single box. Although it can be done easily, a more desirable design would permit successive tightening of the knobs. Regardless, this hold down system is judged to be very good and should be considered by designers for future applications.

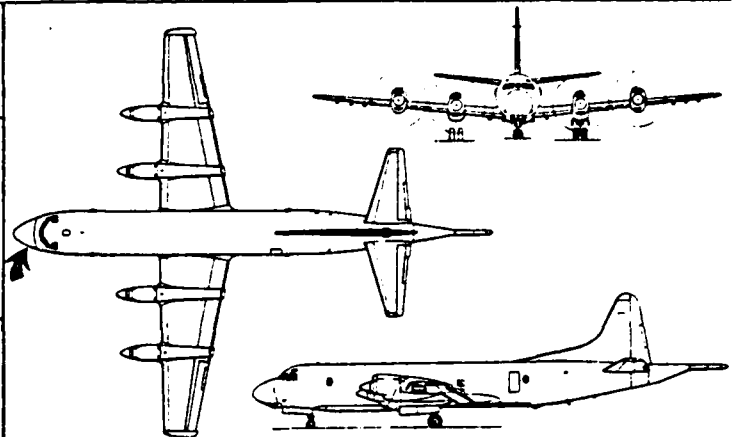
NOMENCLATURE: Nose Radome
PHOTO ID NO.: 59

WORK UNIT CODE: 11123
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Forward fuselage, nose

2. SUPPORT EQUIPMENT:
☐ None ☒ Hoist/Sling
☒ Workstand (2) ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open radome latches (6).

5. REMOVAL: 1. Remove bungee bolts (2), arm clevis pins (2).
2. Remove main arm mounting bolts (2) and bonding wire.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Open and close radome.
2. Check gap tolerance.

8. ANALYST'S COMMENTS: Radome removal/installation is straightforward. Tool and hand access around bolts is good. Because of the size of the radome and the height of its main attach points, NARF workers placed one stand on top of another in order to reach the bolts. The large size of the antenna and radar receiver/transmitter hampers working room and can be damaged during radome removal. The main arm bolts are very difficult to align with the mounting holes during installation. Organizational level users note that the springs in the latches are easily undone accidentally and become lost, requiring latch replacement since the springs cannot be ordered separately. Frequently, squadron personnel do not have a sling and hoist, and removal of the radome requires five people.

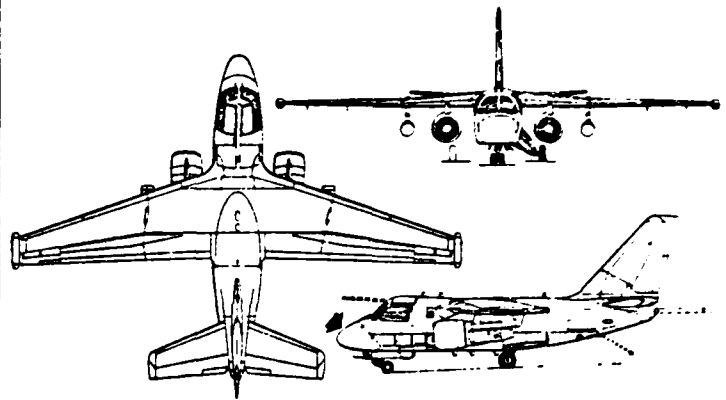
NOMENCLATURE: Radome
PHOTO ID NO.: 114,115

WORK UNIT CODE: 11124
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Forward fuselage, nose

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 6 latches.

5. REMOVAL: 1. Remove two bonding wires.
2. Remove two taper fit bolts.
3. Remove two pip pins.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☒ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☒ None Power Requirements: ☐ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: -

8. ANALYST'S COMMENTS: For a large radome, this installation is very good. The attach points are minimized and are easy to reach. The size of the radome makes it awkward to work around. Replacement radomes are issued with latches separate, requiring them to drill the attach holes. All radomes should be designed interchangeable so that spares can be shipped with latches installed.

NOMENCLATURE: Pilot/Copilot Seat
PHOTO ID NO.: 150

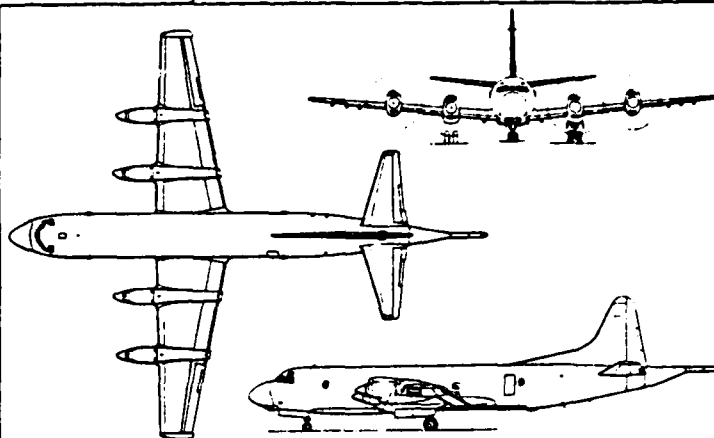
WORK UNIT CODE: 12113
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Cockpit

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
 Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL:
1. Remove 4 stops (bolts and spacers).
 2. Move seat aft, lift back rollers out of track.
 3. Move seat forward, lift front rollers out of track.
 4. Remove seat.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☒ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: -

8. ANALYST'S COMMENTS: This is a very straightforward installation. The seat stops are easy to get to and the seat moves freely in its track. This seat shares very little in common with seats in the S-3A and fighter attack aircraft which are designed for ejection. Organizational personnel only had one problem concerning the design of this seat. The webbing on the seat has a cord along the edge which fits into a channel. This cord keeps popping out of the channel and eventually wears, requiring complete webbing replacement.

NOMENCLATURE: Ejection Seat Assembly IE-1
PHOTO ID NO.: 132

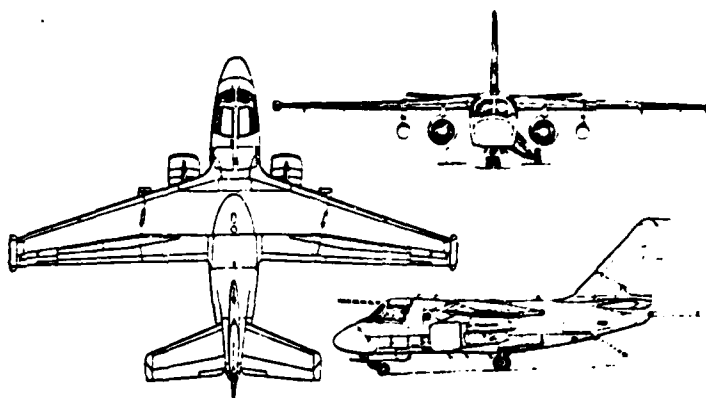
WORK UNIT CODE: 12111
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Cockpit

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Inertia Reel Key
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: To remove pilot or co-pilot seat: remove one hatch, 109 high-torque screws, one inner glare shield, 22 screws. To remove TACCO/SENSO seats: remove 102 high-torque screws on hatch, 31 on fillet. All hatches and fillets require removal or disconnection of Shielded Mild Detonating Cord.

5. REMOVAL: 1. Remove parachute and survival kit (3 disconnects).
2. Remove seat cover (4 screws), remove M99 initiator cover (10 screws).
3. Remove quick disconnect (use inertia reel key).
4. Remove seat trunnion to rocket bolt.
5. Disconnect gas line on top of rocket.
6. Remove seat.

6. INSTALLATION: ☒ Reverse Of Removal
Reset yaw vane after seat is installed.

After Installation Actions: ☐ Bleed ☐ Rig ☒ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Move seat up and down.
2. Check clearances, firing gates.

8. ANALYST'S COMMENTS: The seat installation itself is very good, straightforward, and easy to remove. Only one main attach bolt is used and line disconnects are minimized. Access to the M99 initiators is hampered slightly due to the number of screws in the cover (10). These initiators cannot be safetied or replaced except with the seat down. The seat is relatively light and squadron personnel usually lift it out by hand instead of using a sling.

However, this design is flawed by the access requirements to get the canopies/hatches off. The canopies/hatches use far too many screws, all High Torque, and the TACCO and SENSO seats require removing the upper and lower wing fillets. Designs should be such that this quantity and type of fastener is avoided.

NOMENCLATURE: Main Entrance Door
PHOTO ID NO.: 145

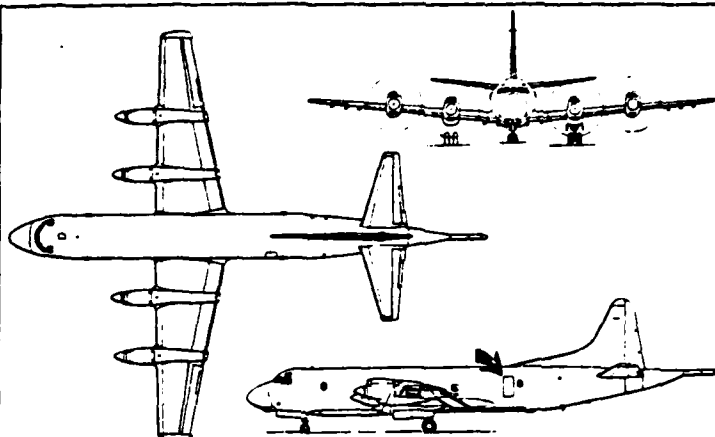
WORK UNIT CODE: 11228
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center fuselage, left side

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove arm bolts (2).
 2. Remove door hinge bolts (2).
 3. Remove door hinge bushings (2).

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify): Rig hinge and four stops.

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Open and close door to check rigging.
 2. Pressurize aircraft cabin and check for leaks (use APU).

8. ANALYST'S COMMENTS: This door installation is a good design. The only problem occurs during installation of the door. The weight of the door (about 50 pounds) and its size cause personnel to have a difficult time inserting the bushings in the door hinge. Once the bushings are in, the bolts slip in easily.

The lower portion of the P-3C door is hinged up when the door is stored in the open position. This portion of the door gets kicked and hit frequently. It is partially made of plastic. These plastic parts break and they are not in abundant supply. Panels in high traffic areas should be made of a more durable material.

NOMENCLATURE: Aircraft Personnel Door
PHOTO ID NO.: 111,112

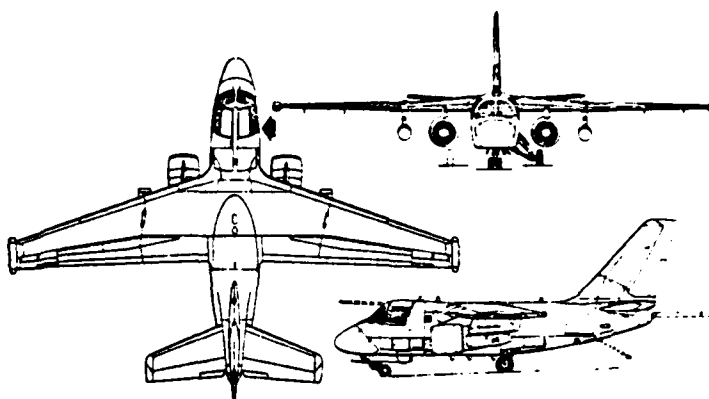
WORK UNIT CODE: 1113A
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Forward fuselage, starboard side

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Manipulate tension cable in snubber to proper position.
2. Disconnect tension cable clevis (1 bolt).
3. Remove hinge bolts (2).

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☐ Electric ☐ Hydraulic
Access Required:
Test Equipment Required: potentiometer
Actions: 1. Check door cable tension and door for proper operation.

8. ANALYST'S COMMENTS: This is an outstanding installation. The door can be removed very simply and quickly. The primary problem with the door is the tension cable, which snaps frequently from personnel loading. There is also a problem trying to maintain the proper tension on the cable.

NOMENCLATURE: Bomb Bay Door Actuating Cylinder
PHOTO ID NO.: 153,154

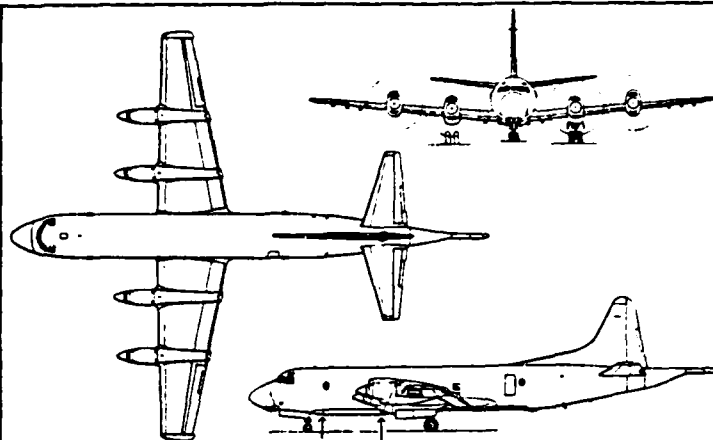
WORK UNIT CODE: 1152A
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Forward fuselage, lower

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open bomb bay doors.

5. REMOVAL: 1. Disconnect hydraulic lines (2).
2. Remove lock tabs from lower attach points (2 bolts).
3. Remove cotter key and lower mounting bolt (1 nut).
4. Remove covering, upper attach point (2 bolts, no nuts).
5. Remove attachment pin.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☒ Other (Specify): Adjust forward electrical switches.

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform operational check of bomb bay doors using hydraulic power and also using manual handpump in cockpit.

8. ANALYST'S COMMENTS: This is a very good installation. Components are in open and easily accessible areas. Actuator removal will usually not require rigging or door arms or adjustment of electrical switches that is routinely done by NARF personnel. Grease seals which should be replaced on installation, are not always available. Faulty seals will occasionally cause the upper attach pin to freeze in place.

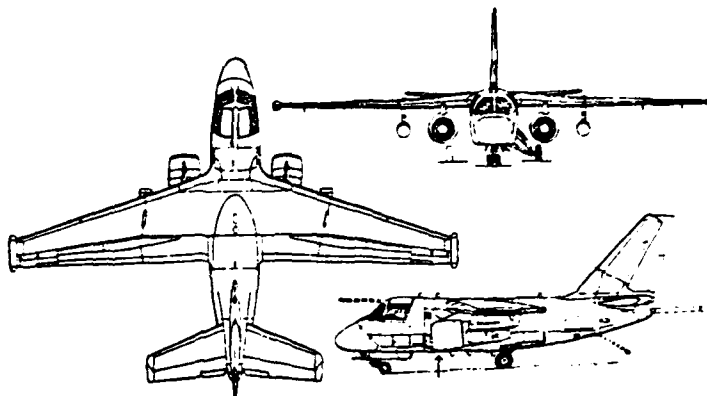
NOMENCLATURE: Power Drive Actuator (Bomb Bay Door)
PHOTO ID NO.: 125

WORK UNIT CODE: 11211
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Center fuselage, bottom

2. SUPPORT EQUIPMENT:
☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: One panel (16 high-torque screws).

5. REMOVAL: 1. Disconnect cannon plugs (2) and hydraulic lines (2).
2. Disconnect forward external flex drive and side flex drives (2).
3. Remove three mounting bolts (High-Torque bolts).
4. Remove actuator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☒ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Perform operational check on bomb bay doors.

8. ANALYST'S COMMENTS: This is an outstanding installation. It is easily accessible on the bottom of the aircraft. The mounting is simple and the connections minimized. The flex drives are spring loaded and slip on and off the splines without use of fastening hardware - very clean, very simple.

LANDING GEAR SYSTEM

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
MLG Wheel and Tire	1343A	13531
NLG Wheel and Tire	13238	13231
MLG Wheel Brake	1352D	13611
MLG Shock Strut	13411	13511
NLG Shock Strut	13211	13211
Nose Wheel Steering Unit	13322	13311
Arresting Hook Assembly	N/A	13710
Brake Control Valve	N/A	13622
Emergency Air Bottle/Accumulator	13538	13632

SYSTEM: LANDING GEAR

• *GENERAL COMMENTS:*

The S-3A design and maintenance concept includes substantial effort toward prevention and retardation of corrosion. One of the methods used throughout the aircraft, but especially prevalent in the landing gear system, is the use of sealants on most joints, bolts, and nuts. Although intense corrosion prevention is required since corrosion is a Navy-wide problem, additional consideration should be given to the types of sealants used to attain this goal. Much of the sealant used is MIL-S-8802. Technicians indicated this sealant is used on all major faying surfaces in the landing gear system, occasionally with a parting agent. It is also used on nuts, washers, placards, and bolts. MIL-S-8802 has a long cure time (24-32 hours) and dries rather hard. Squadron personnel reported not using the sealant because, either there was no time available to allow proper curing, or because the item was frequently removed and sealant cleanup slowed down the replacement action on the flight line.

Sealants provide an efficient, effective vehicle to help prevent corrosion and should be used to a maximum extent. However, design and materials engineers should strive to use a sealant with a short cure time and one which dries soft so as to be easily peeled off.

• *NOSE AND MAIN LANDING GEAR WHEEL AND TIRE ASSEMBLIES:*

The wheel and tire assembly installations must be considered standard for Navy aircraft. All utilize an axle nut, axle lock bolt, inner and outer bearing, and have outstanding access. The S-3A bearings are held in place with retaining rings and come out when the wheel and tire assembly do. This is also the case with the inner bearing of the P-3C. This bearing retention design is a good maintainability feature. This arrangement minimizes bearing damage and contamination. The P-3C utilizes two holes in the axle for the lock bolt, making it simpler for the maintenance person to maintain torque values. The S-3A has only one hole – a drawback. The S-3A bearings can be interchanged, inner to outer and vice versa. Designs should be such to preclude this "Murphy" situation by making bearings distinctly different or by designing both bearings the same size. The P-3 has a simple brake alignment tool which quickly aligns the discs to speed wheel and tire installation.

Since the wheel and tire assemblies are frequent unscheduled removal items, designs should be maximized to limit brake alignment, bearing handling, and wheel adjustment.

• *BRAKE ASSEMBLY:*

Working space for the brake assembly on both aircraft is very good. Wheel and tire assemblies require removal subsequent to brake work. The S-3A brake is held on by one bolt, about as easy an attachment as can be obtained. Conversely, the P-3C brake is held on by twelve bolts, a quantity which should be avoided. The S-3A brake is made from beryllium and this is a serious maintenance problem. Beryllium dust is hazardous to health and protective clothing and dust masks must be worn during maintenance. The dust also contaminates the frequently removed wheel and tire assembly and precautions are similarly applicable to that component. Although beryllium decreases the weight of the brake, it also detracts from the maintainability features. The P-3C uses a chined surface on the axle which automatically assists in disc alignment, a positive feature, in easing maintenance and preventing casual damage.

Brake assemblies should be designed to minimize attachments and hose disconnects, to simplify disc alignment, and to be self-bleeding, i.e., the ability to eliminate air during the first engine run after brake system maintenance without taking any additional maintenance steps.

- **NOSE AND MAIN LANDING GEAR SHOCK STRUTS:**

In general, the shock struts on these aircraft are easy to work on. Both have ground support dollies effective in carrying the weight of the gear. The S-3A axle beam disconnects from the nose strut, eliminating the need to remove the wheel and tire assemblies separately. The main gear strut on the S-3 is removable without removing the wheel and tire assembly. This is a good maintainability point. The S-3A nose landing gear trunnion-bolts are removed through the radome access where working room is ample. Both P-3C struts use a fulcrum/saddle type main mounting bolt arrangement. This requires no additional access and they are easily removed. The size of the P-3 helps keep the wheel wells clear while the S-3 nose well working room is cramped, but no more so than other carrier-based aircraft.

The S-3A main gear shock strut requires the spyder assembly and uplock target to be removed to perform corrosion protection. This unnecessarily adds to the Organizational level task and should be included as part of the Intermediate shop build-up. The P-3C shock struts are wider than the wheel well opening at the point they are attached. This requires jockeying of the strut as it is moved to avoid damage. Because of the tight fit on the S-3A upper attach fitting, a special tool is required to assist in tapping the bolt out.

Designers, when putting together a shock strut installation, should provide for as little build-up of a strut on the flight line as possible.

- **NOSE WHEEL STEERING UNIT:**

The nose steering cylinders operate on two different principles. One is a gear operated unit (S-3A) which meshes into a corresponding gear on top of the shock strut; the other (P-3C) is a wire rope/cable actuated system. Very little can be said about the installations except they are good. The P-3C unit is out in the open and disconnects simply. The S-3A is heavier and mounts higher on the strut, posing an alignment problem between bolt and bushing upon installation. Simplified indexing and alignment on actuators as in the S-3A with its rig pin for gear alignment is an excellent feature which provides advantages over most previous designs.

- **ARRESTING GEAR ASSEMBLY**
- **ANTI-SKID CONTROL VALVE:**

The S-3A hook assembly is a good design. The shank and hook point are removed very simply from the drag brace and require no special tools. The removal of the entire assembly is marred by the need to remove four panels with 102 fasteners to reach the attach bolts. Attach bolts should be more accessible. If panels are required, fasteners should be held to an absolute minimum. This actuator has an integral pressure source and the service fittings are hard to reach. Designers should consider a servicing panel on the fuselage skin as a viable alternate service port. The P-3C has no arresting gear.

The S-3A anti-skid control valve is mounted very simply. However, it is tucked into a corner by the main landing gear shock strut mount and it is difficult to remove some of the connectors/fittings. Much like other Navy aircraft, this component should be relocated to provide better access.

- **EMERGENCY AIR BOTTLE/ACCUMULATOR:**

Both emergency air bottles are conveniently located. The removal ease differs. The S-3A accumulator installation is outstanding. It is held in place with band clamps and has only one hydraulic line to disconnect. The P-3C bottle mounting and pneumatic lines are hard to reach and require some blind work. The bottle is mounted on top of a compartment to floorboard stringers. However, little space exists between the floorboard and the stringer. Although generally a high reliability item infrequently removed, care in design still should be given to hand/tool room for mounting because, eventually, it will require replacement.

NOMENCLATURE: Main Landing Gear Wheel Tire Assembly
PHOTO ID NO.: 139

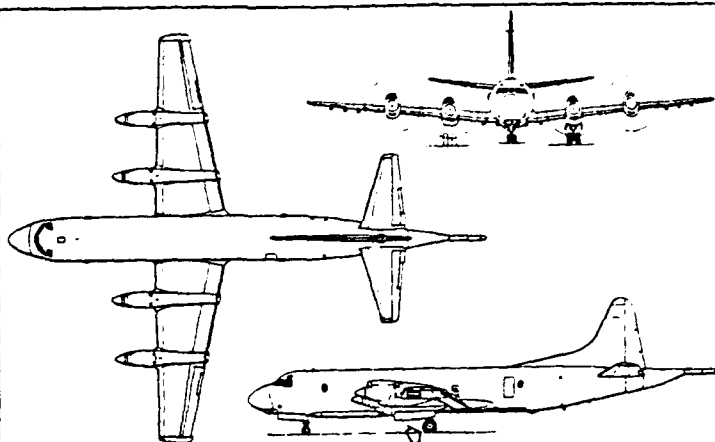
WORK UNIT CODE: 1343A
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Main landing shock strut

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☒ Service (Type)
☐ Electric Nitrogen
☐ Hydraulic Tire Support Jack
Brake Adjustment Tool

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☒ Other (Specify): Jack Shock Strut



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove dust cap, axle locking bolt, outer bearing.
2. Deflate tire.
3. Use tire support jack, remove wheel/tire assembly.

6. INSTALLATION: ☒ Reverse Of Removal
Use brake tool to align brake discs.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight, ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☒ None Power Requirements: ☐ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Rotate tire to check for binding.

8. ANALYST'S COMMENTS: Inner bearing is held in by a retaining ring, a good feature. Outer bearing also should be held in place in the same manner to make this an outstanding design. General installation is similar to installations on all other Navy aircraft.

NOMENCLATURE: Main Landing Gear Wheel/Tire Assembly
PHOTO ID NO.: 121

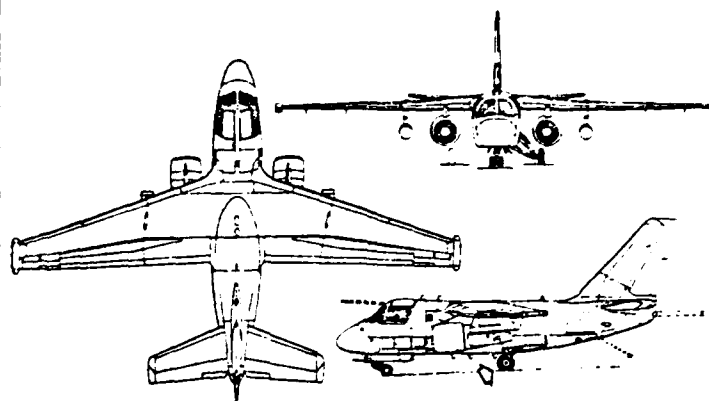
WORK UNIT CODE: 13531
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Main landing gear shock absorber

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Axle Nut Wrench
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Let air out of tire.
2. Remove hub cap (snapping).
3. Tighten disc alignment bolts, remove lock bolt and axle nut.
4. Remove wheel, bearings, and seals.
5. Remove spacers, wheel and tire assembly.

6. INSTALLATION: ☒ Reverse Of Removal
Torque axle nut.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Rotate tire to check for binding.

8. ANALYST'S COMMENTS: This is a very simple installation. The tire comes off easily and the wheel bearings are held in the assembly with snap rings - very meritorious. The only drawback to the installation comes from the brakes and not from the wheel and tire assembly. The brakes are made from beryllium, the dust of which is hazardous to health. This requires the wheel and tire assembly to be bagged and for all personnel, tools, and working areas to be cleaned after working on the assembly.

Squadron personnel report two "Murphy" situations arise which designers should avoid. The bearings can accidentally be interchanged and the snap rings which hold them in place can be exchanged for outsized rings.

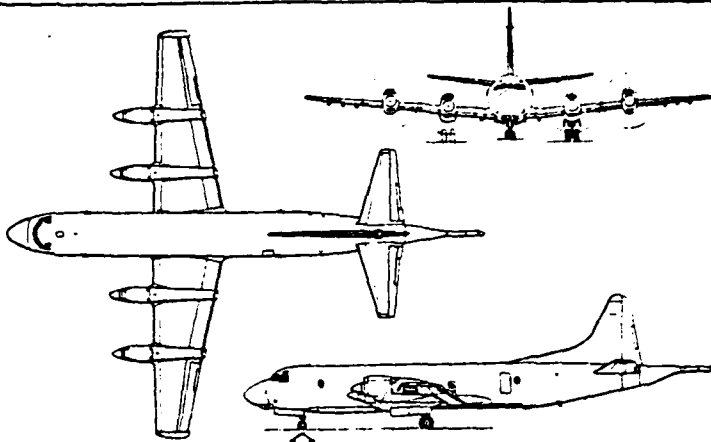
NOMENCLATURE: Nose Landing Gear Wheel/Tire Assembly
PHOTO ID NO.: 160

WORK UNIT CODE: 13238
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Forward fuselage, bottom

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Deflate tire.
2. Remove dust cover and nut retaining bolt.
3. Remove axle nut and outer wheel bearing.
4. Remove wheel and tire assembly.

6. INSTALLATION: ☒ Reverse Of Removal
Torque axle nut.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☐ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Check tire for freedom of rotation.

8. ANALYST'S COMMENTS: This installation can be considered standard for naval aircraft. One strong feature is the fact that the inner wheel bearing is held into the assembly by a retaining ring and does not require separate removal. An improvement could have been made had the outer bearing been installed in a similar manner. Two holes through the axle allow easy alignment of the axle bolt after torquing of the nut, a good feature.

NOMENCLATURE: Nose Landing Gear Wheel and Tire Assembly
PHOTO ID NO.: 122

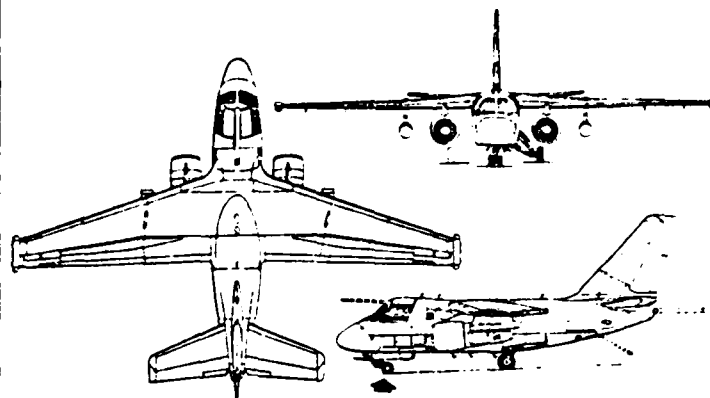
WORK UNIT CODE: 13231
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Nose landing gear shock strut

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Deflate tire.
2. Remove lock bolt from axle, remove axle nut.
3. Remove tire, bearings, seals, spacers.

6. INSTALLATION: ☒ Reverse Of Removal
Torque axle nut

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Rotate tire.

8. ANALYST'S COMMENTS: This is basically a standard wheel installation. It utilizes an axle nut and axle lock bolt. The wheel also uses a snap ring to hold the bearing in, a decided advantage. The snap ring allows the bearings to be removed with the assembly, thereby reducing removal time and chance of damaging bearings or axles. It is difficult to insert the lock bolt while still maintaining torque tolerances. This design provides only one hole through the axle for inserting the axle bolt. Axle design should provide two holes for ease of inserting the lock bolt and maintaining specified torque.

Although not a frequent event, squadron personnel indicated the bearings could be inadvertantly exchanged. Designs should preclude this "Murphy" situation.

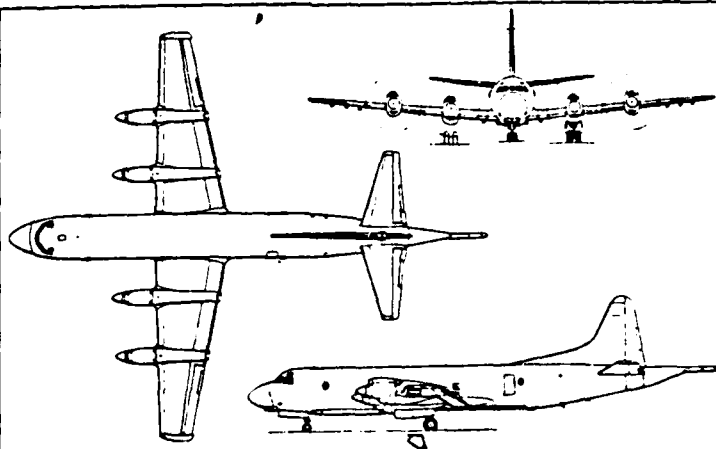
NOMENCLATURE: Brake Assembly
PHOTO ID NO.: 136

WORK UNIT CODE: 1352D
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Main landing gear shock strut

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☒ Other (Specify):
Jack shock strut



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove wheel and tire assembly.
2. Cut lockwire, remove bolts (2) holding shuttle valve in place.
3. Remove bearing spacer (snap prongs), remove twelve nuts and bolts.
4. Remove brake.

6. INSTALLATION: ☒ Reverse Of Removal

1. Torque bolts, reset brake fuse before bleeding by pumping brake.

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Apply brakes and check adjusting pins for proper operation
(maximum of two allowed to be inoperative)

8. ANALYST'S COMMENTS: Access to the component is good and removal and installation is straightforward and considered standard. The exception to this is the use of 12 bolts to hold the brake in place. This is excessive and time consuming. On the plus side is the chined surface on the axle which facilitates brake alignment on installation. Caution is required in handling the brake because of its weight (60 pounds).

NOMENCLATURE: Brake Assembly
PHOTO ID NO.: 60

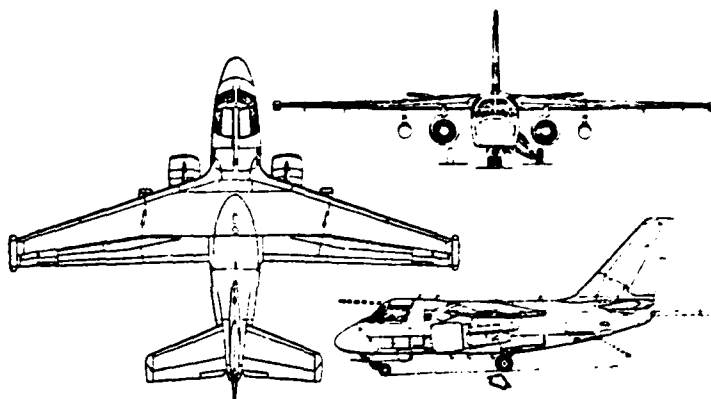
WORK UNIT CODE: 13611
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Main landing gear shock strut

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Protective Gloves
☐ Hydraulic Disposable Coveralls
Dust Mask

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove wheel and tire assembly.
2. Remove shuttle valve hydraulic line, brake retaining bolt.
3. Remove brake assembly.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Check clearance of discs after brakes are put on.
2. Apply brakes.

8. ANALYST'S COMMENTS: This would be an outstanding installation if the brakes were not made of beryllium (a weight saving feature). Removal and installation of the brake is quick and easy, with good accessibility. However beryllium dust (a natural product of brake use) is hazardous to a person's health. Protective clothing is required when handling the component as well as the wheel and tire assembly. Removed components must be plastic wrapped and the work area washed and cleaned after the maintenance action. Although beryllium provides a light, efficient brake, its use negates all the good maintainability features exhibited in this design.

NOMENCLATURE: Main Landing Gear Shock Strut
PHOTO ID NO.: 137,138

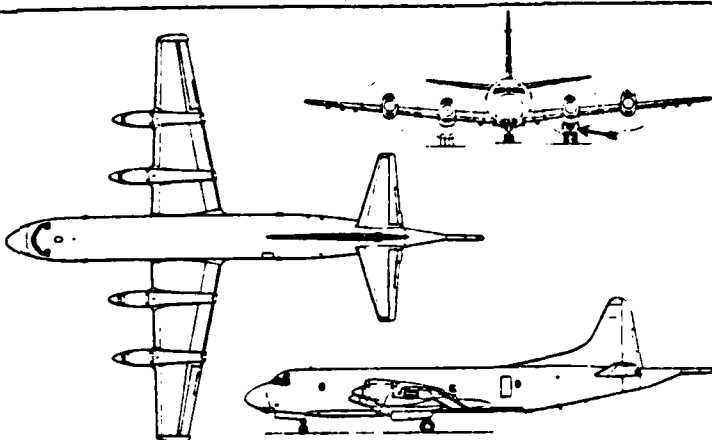
WORK UNIT CODE: 13411
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Fuselage, center, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Nose and Main Gear
☐ Hydraulic Jack
Spring Tool (bungee)

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open hydraulic servicing center access (one handle).
(Panel slides out of way on rails.)

5. REMOVAL:

1. Deflate shock strut.
2. Place manual shutoff valve in closed position, release hydraulic reservoir pressure.
3. Disconnect and remove aft landing gear doors (2 bolts, bonding wire).
4. Remove fireshield panels, disconnect 2 electrical connectors and remove mounting hardware.

(See continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1- Check for proper operation of MLG uplock hook.
2. Perform operation check of MLG system.

8. ANALYST'S COMMENTS: For a large shock strut, this installation is excellent. All bolts, fittings, and hoses are in plain view with plenty of working space. The special nose and main gear jack attaches to the shock strut simply and eliminates physical handling of the strut. The only minor drawback is that the strut needs to be jockeyed around a bit to lower it out of the aircraft. This is because the gear is slightly wider at the top than the door opening. Personnel also must ensure trunnion bolts have fuel sealant on them to prevent fuel leaks because the trunnion bolts go into the wing fuel tanks.

NOMENCLATURE: Main Landing Gear Shock Strut

WUC: 13411
AIRCRAFT: P-3C

5. REMOVAL: (Continued)

5. Disconnect 2 hydraulic lines, actuator (1 bolt), door bungee springs, yoke (2 bolts).
6. Remove bolts (4) from trunnion assembly, remove shock strut.

NOMENCLATURE: Main Landing Gear Shock Absorber
PHOTO ID NO.: 116

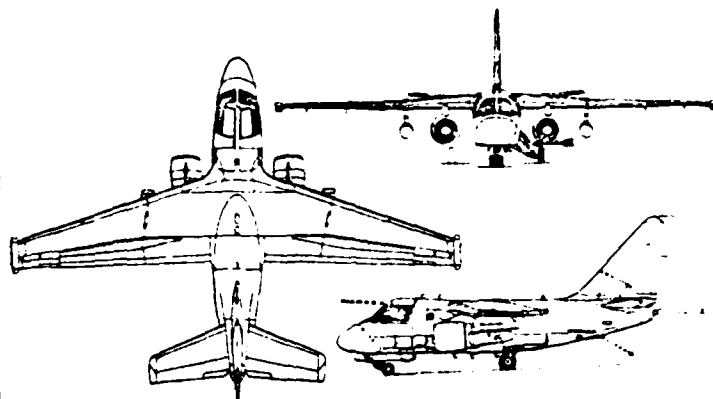
WORK UNIT CODE: 13511
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Center fuselage

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric Bolt Removal Tool
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL:
1. Deflate shock strut and disconnect three door links (1 bolt each).
 2. Remove tension bolt, cotter key.
 3. Remove safety bracket (4 screws).
 4. Remove nut, washer from bulkhead attach bolt.
 5. Install bolt removal tool and tap bolt partially out.
 6. Remove bushing, then bolt.
 7. Remove shock strut.

6. INSTALLATION: ☒ Reverse Of Removal
1. Disassemble spyder assembly (2 screws, 1 pin) and target uplock assembly (2 bolts) for corrosion prevention prior to installing shock strut.
 2. Perform hydraulic servicing uninstalled.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required:

Test Equipment Required:

- Actions:
1. Perform a functional check of the landing gear system.
 2. Re-connect doors during functional check.

8. ANALYST'S COMMENTS: This is a good installation. Disassembly for removal is limited and the wheel and tire assembly does not have to be removed - both advantages. From a maintainability standpoint, disassembly of the spyder assembly and target uplock prior to installation is a drawback. Corrosion protection on struts from supply should be included as part of the intermediate level build-up. Organizational corrosion prevention should be on an "as needed" basis rather than a mandated procedure prior to installation. Hydraulic servicing of the strut prior to installation is advantageous because it allows greater access to the upper fitting and for clean up. However, a potential "Murphy" situation exists since care must be taken that the strut is fully compressed and in a vertical position to ensure no air is trapped.

NOMENCLATURE: Nose Landing Gear Shock Strut
PHOTO ID NO.: 140,142

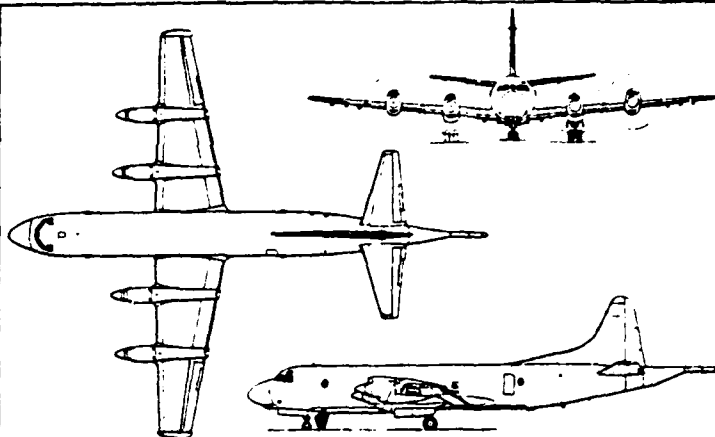
WORK UNIT CODE: 13211
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Forward fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify): Trunnion Nut Wrench,
Nose and Main Gear
Jack, Spring Tool



4. ACCESS/CLOSE UP: Open access door to hydraulics compartment (one handle).
(Panel slides out of way on rails.)

5. REMOVAL: 1. Relieve hydraulic reservoir pressure, place manual shutoff valve in close.
2. Disconnect taxi light, one electrical connector, actuating cylinder (2 bolts, 1 pin).
3. Disconnect downlock rod (1 bolt), landing gear door (2 bolts, cotter pins).
(See continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify): Rig steering cables

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Check nose landing gear uplock hook operation.
2. Perform nose landing gear operational check.
3. Check nose gear steering for proper operation.

8. ANALYST'S COMMENTS: For a large shock strut this installation is excellent. All of the bolts, fittings, and hoses are in plain view with plenty of working space. The special nose and main gear jack attaches to the shock strut simply and eliminates manhandling of the strut. The only minor drawback is that the strut needs to be jockeyed around a bit to lower it out of the aircraft. This is because the gear is slightly wider at the top than the door opening.

Organizational people interviewed had not removed a strut but indicated the lower gland nut can be removed for cylinder repacking without taking the shock strut out. This is another strong plus.

NOMENCLATURE: Nose Landing Gear Shock Strut

WUC: 13211

AIRCRAFT: P-30

5. REMOVAL: (Continued)

4. Remove wheel and tire assembly, deflate shock strut.
5. Disconnect nose steering cables (2), hoses (2), drag brace (2 bolts, cotter pins).
6. Disconnect fulcrum bolts (4), remove shock strut.

NOMENCLATURE: Nose Landing Gear Shock Strut
PHOTO ID NO.: 124

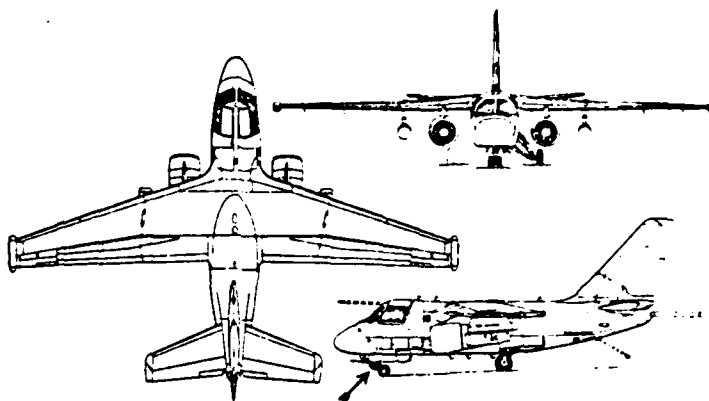
WORK UNIT CODE: 13211
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Forward fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☒ Jacks
Power (Type) ☐ Service (Type)
☐ Electric NLG Shock Strut
☐ Hydraulic Adapter and Dolly

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☒ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open radome (4 latches), remove radar absorption blanket, remove fiberglass panels.

5. REMOVAL:
1. Remove axle beam (1 pin) and tension link (2 bolts).
 2. Disconnect launch bar (4 bolts, 2 pin cams).
 3. Disconnect upper end of NLG door connecting links tie door back.
 4. Remove steering cylinder mounting bolt nut, taxi light (1 plug, 1 bolt).
 5. Disconnect hydraulic hose, taxi light wiring support clamp.

(See continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☒ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform functional check of nose landing gear, launch bar, steering mechanism, and nose gear doors.

8. ANALYST'S COMMENTS: For a large heavy component, this is a good installation. The strut installation disassembles into several major subcomponents, which are held together with a minimum of hardware. The dolly and adapter attach to the strut to minimize handling of the heavy gear. Work space is crowded but no more so than in other aircraft.

NOMENCLATURE: Nose Landing Gear Shock Strut

WUC: 13211

AIRCRAFT: S-3A

5. REMOVAL: (Continued)

6. Disconnect lower forward drag link.
7. Deflate shock strut.
8. Remove bolts from trunnion pins, remove trunnion pins.
9. Remove shock strut.

NOMENCLATURE: Nose Landing Gear Control Valve
PHOTO ID NO.: 141

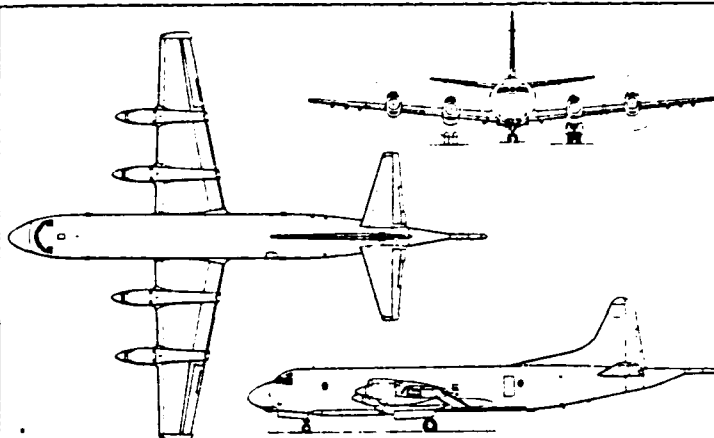
WORK UNIT CODE: 13322
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Nose shock strut

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Disconnect cables (2) at turnbuckles, cut safety wire on mounting bolts.
2. Remove guard (6 bolts).
3. Disconnect hydraulic lines (4).
4. Remove pulley covers (4 pins), displace wire rope.
5. Remove valve.

6. INSTALLATION: ☒ Reverse Of Removal
Safety lower four attaching bolts.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required: Potentiometer
Actions: 1. Check steering for left, right movement and for centering.
2. Check steering cable tension.

8. ANALYST'S COMMENTS: Access to the component itself is very good. However, there is insufficient room for fingers and tools on the lower four attach bolts. The bolts which hold the guard on also hold the unit in place, a good feature since repair in place does not require guard removal.

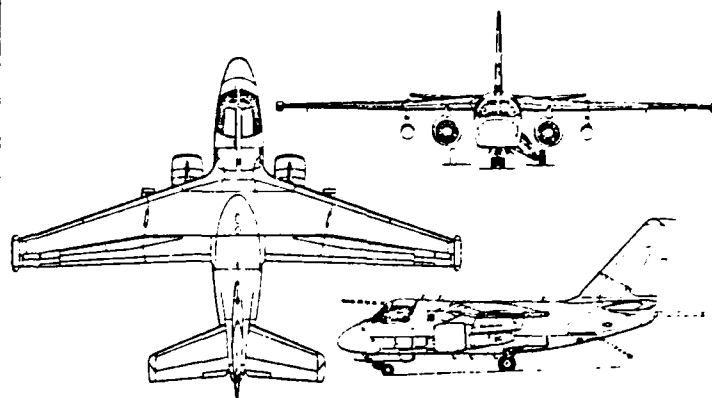
NOMENCLATURE: Nose Landing Gear Steering Servo Cylinder
PHOTO ID NO.: 123

WORK UNIT CODE: 13311
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Nose landing gear shock strut

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Special Rigging Pin
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Align wheels forward, disconnect electrical plug.
2. Remove gear cover (4 bolts, 2 screws).
3. Disconnect actuator from rear lug by removing nut; disconnect hydraulic hose.

(See continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform functional check of steering system.

8. ANALYST'S COMMENTS: Overall, this is a good installation. Although working room is awkward because of the landing gear door and small space in the wheel well aft of the shock strut, access to the component and attaching hardware is good. The weight of the cylinder and its high mounting position on the strut combine to make alignment and installation of the mounting bolt difficult. Even with the special rig pin, it is easy to "mess up" the gear alignment upon installation. They also indicate the electrical connectors have caps which either get lost or break, causing corrosion to begin in the connector. Connector corrosion requires cylinder removal.

NOMENCLATURE: Nose Landing Gear Steering Servo Cylinder

WUC: 13311

AIRCRAFT: S-3A

5. REMOVAL: (Continued)

4. Disconnect brazed hydraulic tubes (2), electrical wire clamp (1 screw), electrical conduit (1 screw). Remove mounting bolt.
5. Remove NLG steering servo cylinder.

NOMENCLATURE: Arresting Gear Hook Assembly
PHOTO ID NO.: 120

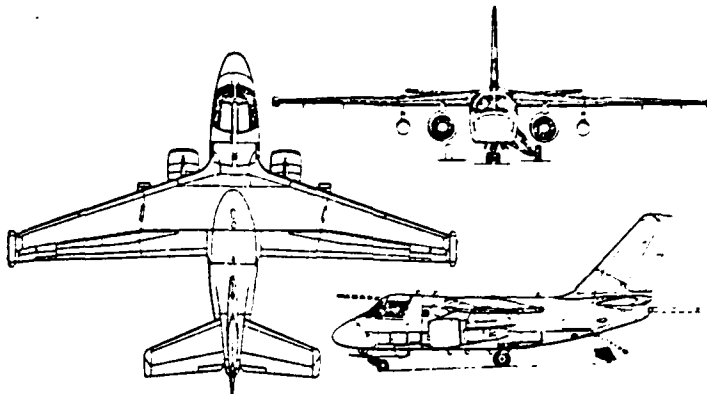
WORK UNIT CODE: 13710
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Aft fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Multi-purpose Dolly
☐ Hydraulic and Adapter

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 2 panels (45 camlocs each).
Open 2 panels (6 screws each).

5. REMOVAL: 1. Depressurize arresting gear cylinder, lower hook.
2. Remove bolt from actuator rod-end.
3. Remove connecting links and roller (1 bolt).
4. Remove shank pin nut, connecting pin hardware (2 bolts).
5. Tap connecting pins out and remove assembly.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☒ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Perform operational check of hook, check clearances.

8. ANALYST'S COMMENTS: This is generally a good installation. Access is good and removal procedure is simple. Improvements could be made if the arresting gear assembly connecting pins could be removed without the need for four access panels to come off. Even the use of a simple special pin puller may be preferable. Removal of the shank or hook point is outstanding and little can be done to improve removal of these sub-components.

Squadron personnel found difficulty reaching the actuator servicing points located on top of the actuator. Moving the service points to a fuselage skin mounted service point or changing the location of the points on the actuator would alleviate this

(See continuation sheet)

NOMENCLATURE: Arresting Gear Hook Assembly

WUC: 13710
AIRCRAFT: S-3A

8. ANALYST'S COMMENTS: (Continued)

problem. Personnel also avoid the use of sealants on this installation, especially on the hook point. MIL-S-8802 sealant requires a long cure time and dries hard, making quick replacement of components on the flight deck difficult at best. If sealants are to be employed for corrosion resistance, they should cure quickly and be soft enough to be easily peeled off.

NOMENCLATURE: Anti-skid Control Valve
PHOTO ID NO.: 117

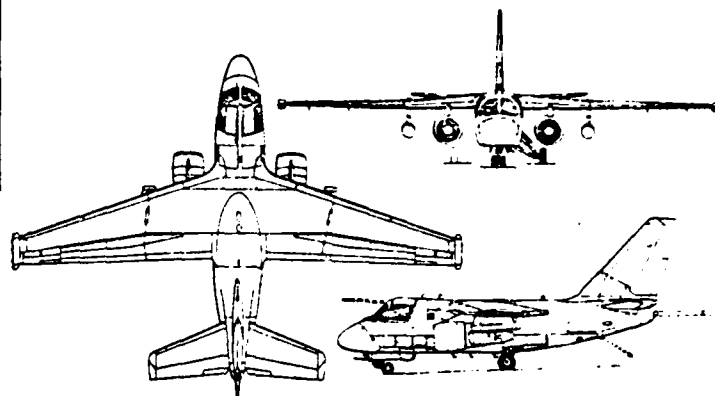
WORK UNIT CODE: 13622
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Left hand wheel well

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric
☒ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Disconnect hydraulic lines (5), cannon plug.
2. Disconnect one bonding wire.
3. Remove three mounting bolts.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Check brakes for proper operation.

8. ANALYST'S COMMENTS: The mounting on this component is simple. However, because of its location near the main mount of the landing gear, working room is awkward and the cannon plug is difficult to work off because of the mount. It is easier to take the valve loose and then disconnect the electrical plug. This compromised situation could have been avoided by slightly changing the location of the valve or of the connector.

NOMENCLATURE: Brake Pneumatic Reservoir
PHOTO ID NO.: 155

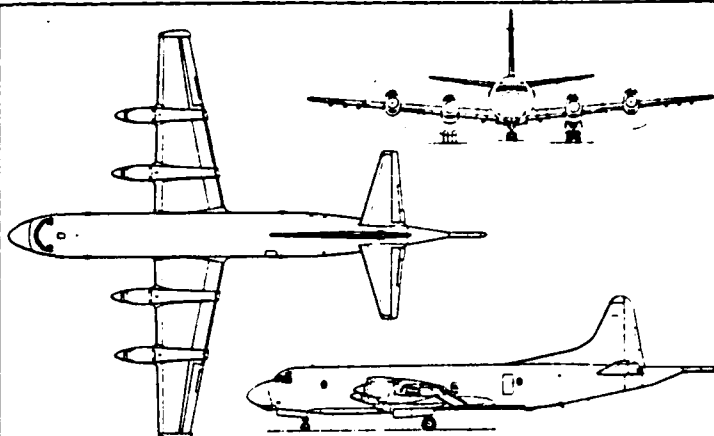
WORK UNIT CODE: 13538
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☒ Service (Type)
☐ Electric Nitrogen Cart
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open lower access door (1 handle).
(Door slides on rail out of way.)

5. REMOVAL: 1. Depressurize reservoir.
2. Disconnect two pneumatic lines (B-nuts, lockwired).
3. Remove mounting bolts (3).

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Check reservoir for leaks.

8. ANALYST'S COMMENTS: Working room in this lower bay is very good for this component. However, the reservoir is mounted to floor board stringers, severely hampering room to remove and replace mounting bolts. Hand and tool space to the bolt heads is limited to such an extent that Maintenance personnel will remove the floor board immediately above the component, install the mounting bolts from above and then go below to install the pneumatic lines. Additionally, the upper hydraulic line and B-nut sit against a stringer and make line removal difficult. Location of that line also makes checking for leaks difficult as it is a relatively blind area. The schrader valve for filling the reservoir is also on top and is difficult to work with. Filling the bottle requires two people, one to handle the nitrogen cart, the other to read the reservoir gage. Servicing usually is done with the APU running, which makes communications difficult.

NOMENCLATURE: Emergency Parking Brake Accumulator
PHOTO ID NO.: 110

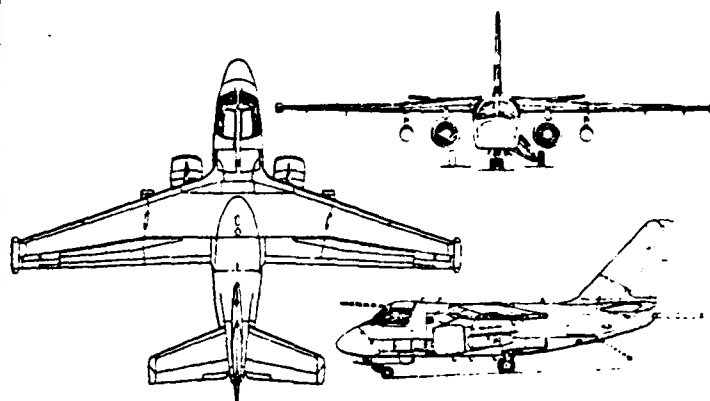
WORK UNIT CODE: 13632
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Right hand wheel well

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☒ Service (Type)
☐ Electric Nitrogen Cart
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Depressurize hydraulic system, depressurize cylinder.
2. Disconnect bonding wire and hydraulic line.
3. Disconnect clamps (2).
4. Remove accumulator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☐ Electric ☒ Hydraulic (handpump)
Access Required:
Test Equipment Required:
Actions: 1. Pressurize system to check for leaks.

8. ANALYST'S COMMENTS: This is an outstanding installation. Access is excellent and working room is plentiful. The unit is held in place with band clamps, which facilitate removal and installation.

FLIGHT CONTROL SYSTEM
CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Elevator/UHT Actuator	14832	N/A
Rudder Actuator	14833	N/A
Aileron Trim Actuator	N/A	14221
Horizontal Stabilizer/Elevator	N/A	14125
LE Flap Assembly	N/A	14722
TE Flap Assembly	1491L	1481C
Aileron	1421A	14328
Pilot's Stick Assembly	N/A	5736A

SYSTEM: FLIGHT CONTROLS

• GENERAL COMMENTS:

All S-3A primary flight control surface movements are powered by dual power servos for each axis of flight control. The use of power servos was a state of the art advancement over previous hydraulic actuator or electric screw actuator systems and provided advantages of packaging, quicker response time and, in the case of the S-3A, the means of providing practical mechanical reversion in the event of loss of dual hydraulic power to any or all servos. The power servo, while incorporating some features of the hydraulic actuator, also provides mechanical features and other hydraulic features not found in a basic hydraulic or electrical actuator. Because of these differences, a comparison cannot be made between the S-3A and other Navy aircraft.

• ELEVATOR/UHT ACTUATOR

• RUDDER ACTUATOR:

The P-3C elevator boost package and rudder boost package are the same basic unit. The packages are mounted side-by-side in a compartment just aft of the aft pressure bulkhead. Replacement requires two persons and, while there is sufficient access, working room becomes cramped once the 100-pound package is loosened from its mounts. The weight and size of the unit and the fact it must be removed through a limited space, raise potentials for mishandling, damage, and personnel injury, a point designers should not overlook. Mounts use two different sets of matched hardware where top and bottom portions fit each other exactly and cannot be used in conjunction with parts of other matched sets, raising distinct possibilities for "Murphyism". Matched hardware should be avoided in design while interchangeable hardware should be stressed. Control of the surfaces to the package is by wire cable, which necessitates extensive rigging when the entire package is replaced. All flight control rigging, P-3C included, should be optimized if not eliminated, and any required rigging holes should be made readily accessible. The elevator boost package rigging requires the removal or displacement of three seats, a floorboard, and an oxygen bottle. Designs should avoid removing non-associated components to reach rig pin holes.

On the plus side, the hydraulic components (except the actuator), which fail most frequently, may be removed individually and are installed pre-rigged. This is a good maintenance feature.

• AILERON TRIM ACTUATOR:

In general electro-mechanical trim actuators are maintenance savers because of their size and simplicity. However, in the S-3A pitch trim actuator this does not hold true. The S-3A pitch trim actuator is a poorly packaged and installed design. Access, tool room, working space, GSE, and "Murphyism" have been short changed or accentuated. In part, the function and the size of the surface which must be moved (the actuator rotates the complete horizontal stabilizer around a central pivot point) dictated envelope requirements. However, designers should note that access enlargement or additions and minor changes in attachment hardware shape and arrangement would have bettered this installation. The P-3C aileron trim tab actuator was not investigated because it involved small movements of a tab rather than a major surface (aileron or elevator) as evaluated on other aircraft.

• HORIZONTAL STABILIZER/ELEVATOR:

The S-3A complete elevator assembly is large and replacement requires extensive access panel removal. A design objective applicable to all components is for the designer to minimize access panel removal whenever possible. Actual physical removal of the assembly is straightforward. The operational check requires almost laboratory detail. Points must be plotted and then compared to a template. This technique should not be employed on flight line equipment. Operational checks or adjustments should be kept simple and short.

- **LEADING EDGE FLAP ASSEMBLY**
- **TRAILING EDGE FLAP ASSEMBLY:**

The P-3C has no leading edge flaps. Generally leading edge flap installations suffer from lack of space forward of the wing box structure. The S-3A is typical of most aircraft installations. Many panels need to be removed, which is a drawback. However, the flaps need not be prepositioned to a specified point prior to removal, which is meritorious.

Both aircraft use a carriage-type mounting on the trailing edge flaps. The installations are good with access to the attach points adequate. The P-3C carriage connections use too many bolts. The S-3A requires more access panel removal than should be necessary, and the checkout procedures require an impressive array of GSE. To design a sophisticated flight control system through the use of conventional hardware necessitates extensive rigging and GSE. Designers should consider design options utilizing state-of-the-art techniques supported by Life Cycle Cost and Design-to-Cost considerations as viable alternatives to complex conventional designs. Conversely, the P-3C uses an aluminum strip with markings and a small hook on the end to ensure rigging. Initial design of the flaps should include rudimentary thoughts as to checkout procedures to reduce GSE needed.

- **AILERON ASSEMBLY:**

The aileron assemblies use a standard hinge and bearing arrangement and attaching hardware is easy to work on. However, the S-3A requires fourteen panels to be opened to remove or rig the aileron. Removal of many access panels for maintenance should be avoided where possible. Although the P-3C does not require excessive panel removal, its major drawback is the need to remove the wing tip prior to removing the aileron – an undesirable maintainability feature.

- **PILOT'S STICK GRIP:**

The stick grip on the S-3A is a good, simple installation. It involves one bolt and one electrical connector. The installations have one marring feature, the pilot and co-pilot sticks differ slightly in mounting requiring separate installation procedures. One improvement which designers should consider is the use of a snap in connector which mates electrically as well as physically.

The P-3C control column differs substantially from control sticks used on the S-3A and previously examined airplanes and it was not evaluated as part of this study.

NOMENCLATURE: Elevator Hydraulic Booster Package
PHOTO ID NO.: 152,159,151

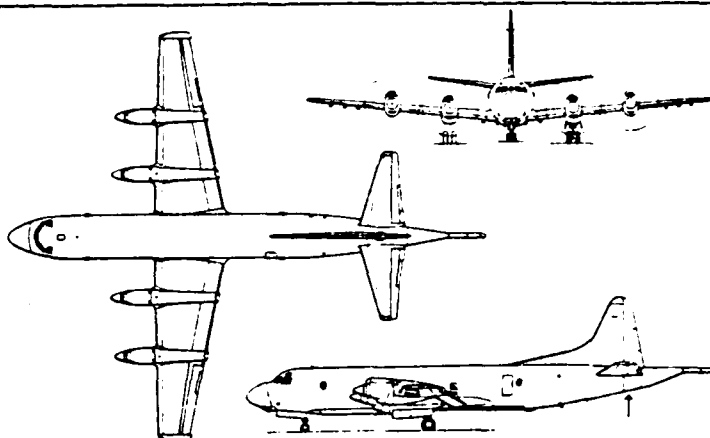
WORK UNIT CODE: 14832
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Tail section

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Cable Tension Regu-
☐ Hydraulic lators, Cable Stops,
Rope

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open hinged access door (14 quick release fasteners).
Open aft radome (4 latches).
Remove eccosorb blanket (snaps).

5. REMOVAL: 1. Depressurize hydraulic reservoir, place elevator boost shift handle to "boost."
2. Loosen auto-pilot emergency quadrant cable guard, disconnect cable.
3. Loosen elevator booster shaft cable, disconnect cannon plugs (5).
4. Remove two cable quadrants (lockwire, 1 bolt, 2 screws, retainer plate).
5. Loosen mounting bolts, disconnect hydraulic lines (2), connecting rod (1 bolt). (see continuation sheet.)

6. INSTALLATION: ☒ Reverse Of Removal

Torque required on several bolts, insertion of rigging pins requires pilot, co-pilot and plane captain seats be removed. Also an oxygen bottle beneath pilot's seat must be displaced.

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform operational check on elevator system.

8. ANALYST'S COMMENTS: This is a very complex installation. The component is mounted in an access aft of the rear cabin bulkhead and forward of the MAD boom. The elevator hydraulic booster package is mounted to the top of this compartment next to the rudder boost package. Although there is room for two people in the compartment, maneuvering room for the uninstalled package weighing 100 pounds, is limited. The component must be jockeyed by rope past the aft radar dish antenna and into the compartment, raising distinct possibilities of damage to both units. The mounting bolts for the unit must be loosened to allow sufficient play for disconnecting the rigid hydraulic lines. NARF personnel install the unit through the rear with the MAD boom off as opposed to sliding the boom back. At this time the wire ropes are disconnected at their turnbuckles and remove the whole assembly, including the quadrants.

(See continuation sheet.)

NOMENCLATURE: Elevator Hydraulic Booster Package

WUC: 14832

AIRCRAFT: P-3C

5. REMOVAL: (Continued)

6. Connect rope to unit to use as support, remove mounting bolts (4).

8. ANALYST'S COMMENTS: (Continued)

The mounting hardware comes in matched serial number sets (left and right, top and bottom) and must be installed as such. Use of two different sets of matched hardware is not desirable as it increases the possibility of "Murphy" situations. Unacceptable maintainability-wise is the access required to insert rigging pins. Removal of three seats, floorboards, and an oxygen bottle to get to the rig pin holes in the control sticks is unacceptable. Rig pin holes should be readily accessible or require very little access.

Squadron personnel indicate the usual failure item on this component is the hydraulic package, which can be taken out separately -a good feature. This portion weighs about 45 pounds and requires six saddle bolts, four hydraulic lines, one linkage, three cannon plugs, one cable disconnect, and one bolt to be removed or disconnected. The replacement package is pre-rigged so no on-aircraft rigging is required -a good feature.

NOMENCLATURE: Rudder Hydraulic Booster Package
PHOTO ID NO.: 152,159,151

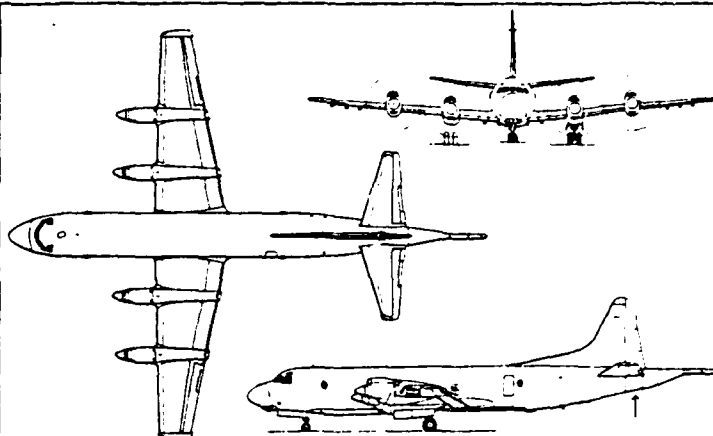
WORK UNIT CODE: 14933
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Tail section

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand 2 ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Cable Tension Regu-
☐ Hydraulic lators, Cable Stops,
Rope

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open nose radome (6 latches). Remove eccosorb blanket (snaps).
Open aft radome (4 latches).
Open hinged access door (14 camlocs).
Open left hand rudder pedal access (50 screws).

5. REMOVAL: 1. Depressurize hydraulic reservoir, place rudder boost shift handle in "boost off."
2. Install rigging pin in main rudder input link (rudder pedal access).
3. Loosen auto-pilot emergency quadrant cable guard, disconnect cable.
4. Loosen cable turnbuckles to provide slack, disconnect cannon plugs (5).
5. Remove quadrants (2), (1 bolt, 2 screws, 1 retainer plate).
(see continuation sheet.)

6. INSTALLATION: ☒ Reverse Of Removal
Torque required on several bolts.

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Perform operational check on rudder control system.

8. ANALYST'S COMMENTS: This is a very complex installation. The component is mounted in an access aft of the rear cabin bulkhead and forward of the MAD boom. The rudder hydraulic booster package is mounted to the top of this compartment next to the elevator boost package. Although there is room for two people in the compartment, maneuvering room for the uninstalled package, which weighs 100 pounds, is limited. The component must be jockeyed by rope past the aft radar dish antenna and into the compartment, raising distinct possibilities of damage to both units. The mounting bolts for the unit must be loosened to allow sufficient play for disconnecting the rigid hydraulic lines. NARF personnel install the unit through the rear with the MAD boom off as opposed to sliding the boom back. At this time the wire ropes are disconnected at their turnbuckles and remove the whole assembly including the quadrants.
(See continuation sheet.)

5. REMOVAL: (Continued)

6. Loosen mounting bolts, disconnect hydraulic lines (2), connecting rod (1 bolt).
7. Connect rope to unit to use as support, remove mounting bolts (4).

8. ANALYST'S OPINION: (Continued)

The mounting hardware comes in matched serial number sets (left and right, top and bottom) and must be installed as such. Use of two different sets of matched hardware is not desirable as it increases the possibility of "Murphy" situations. Insertion of the forward rig pin could be improved and the 50 screw access panel and radome access requirements could be avoided by installing the pin in the cockpit through a small, localized rigging access hole.

The usual failure item of this component is the hydraulic package which can be taken out separately--a good feature. This portion weighs about 45 pounds and requires six saddle bolts, four hydraulic lines, one linkage, three cannon plugs, one cable disconnect, and one bolt to be removed or disconnected. The replacement package is pre-rigged so no on-aircraft rigging is required. When the hydraulic package is removed, there is no GSE available to act as a batten to prevent damage to the rudder and its attach points while the aircraft sits on the flight-line in the wind.

NOMENCLATURE: Pitch Trim Actuator
PHOTO ID NO.: 130,131

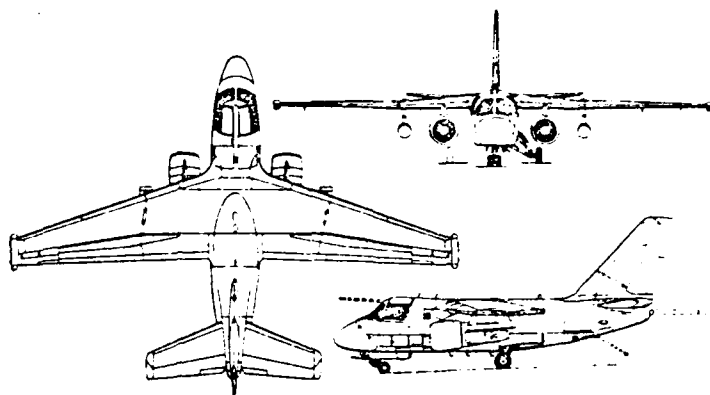
WORK UNIT CODE: 14221
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Vertical tail

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand (2) ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Horizontal Stabilizer
☐ Hydraulic Jack

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: 3 panels (116 high-torque fasteners)

5. REMOVAL:
1. Position stabilizer jack, adjust actuator length using trim button on pilot's stick.
 2. Disconnect electrical connectors (4).
 3. Disconnect actuator at elevator pivot arm (1 clevis pin with cotter key, 1 bolt with safety wire and nut, 1 pin type bushing).
 4. Disconnect actuator at upper attach point (1 clevis pin with cotter key, 1 bolt with safety wire and nut, 1 pin type bushing). (see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal
Torque upper nut while holding bolt steady.

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic
May need airconditioning in hot weather

Access Required:

Test Equipment Required:

- Actions:
1. Perform operation check of actuator.
 2. Ensure both motors drive actuator simultaneously.

8. ANALYST'S COMMENTS: This installation has poor access, no tool room, insufficient space, ample opportunity to "Murphy" the installation, and the GSE requires the support of ancillary test equipment. The actuator is long (3 feet) and heavy (55-60 pounds) and must be inserted from the bottom through the removed tailcone space. This situation could have been improved had the existing access on the side of the vertical tail been larger to allow insertion from above. The space the actuator fits into is very tight. It is further complicated by two electrical boxes on the sides of the actuator which get caught and can be damaged as the actuator is moved. "Murphyism" exhibits itself in that the attach pins can be accidentally inter-changed and that the actuator can be installed upside down. Attachment hardware is extremely difficult to

(See continuation sheet)

NOMENCLATURE: Pitch Trim Actuator

WJC: 14221
AIRCRAFT: S-3

5. REMOVAL: (Continued)

5. Remove actuator.

8. ANALYST'S COMMENTS: (Continued)

install, especially the upper attach point. The upper attach point hardware installs inboard to outboard completely blind (no room for both hands and mirror.) A clevis pin, washer and cotter key must be inserted blindly in the inboard side of the bolt. Many hours could have been saved had an access hole been put in on the other side of the tail opposite the bolt. The electrical drive motors frequently fail and designs should allow for replacement of the sub-components without complete actuator removal. In addition, the test set used to check the actuator is not sensitive enough and requires use of a volt-ohm-meter. Reportedly test procedures are sketchy and an actuator may read within tolerance, but not operate.

NOMENCLATURE: Complete Elevator Assembly
PHOTO ID NO.: 61

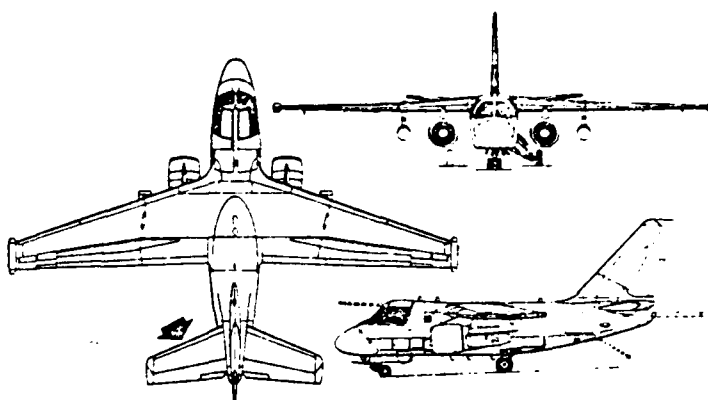
WORK UNIT CODE: 14125
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Aft fuselage

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Rig Pin Kit
☒ Hydraulic (See continuation sheet)

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 10 panels with following numbers of high-torque screws: 6, 20, 43, 25, 25, 46, 13, 6, 6, 6. Open one panel (45 camlocs). Open one panel (fastener unknown).

5. REMOVAL: 1. Remove flutter damper (4 bolts, shims), bonding wire.
2. Disconnect link (2 bolts, nuts, cotter keys, washers).
3. Hold elevator up, remove 12 bolts.
4. Remove hinge bolts (3).
5. Lower elevator to ground.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☒ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements:

☒ Electric ☒ Hydraulic
☒ Airconditioning

Access Required: 2 panels

Test Equipment Required: (see continuation sheet)

Actions: 1. Apply and record downloads and uploads to elevator assembly. Plot the points on graph paper and compare them to a standard template.
2. Perform operation check of elevator rotary flutter damper.
3. Perform a functional flight test to measure pilot/co-pilot stick forces.

8. ANALYST'S COMMENTS: This component installation is compromised by the excessive number of panels required to be removed and by the almost laboratory detail required by the operational test. The elevator itself is large and heavy, requiring a hoist and sling. Connections, except the hinge bolts, for the complete elevator assembly are easy to work on. The hinge bolts employ a pin within a bolt arrangement and make it difficult to align bolt, pin, and attach hole simultaneously.

The operational test for the elevator is very detailed. Squadron personnel must log and then graph on a specific type of graph paper 26 different

(See continuation sheet)

NOMENCLATURE: Complete Elevator Assembly

WUC: 14125
AIRCRAFT: S-3A

2. SUPPORT EQUIPMENT: (Continued)

Elevator Breakout Test Set
Force Measuring Gage
Dial Indicator Assembly

7. FUNCTIONAL CHECK:

Test Equipment Required: (Continued)

Elevator Freeplay Load Measuring Fixture
Elevator Breakout Test Set
Dial Indicator Assembly
Force Measuring Gage
Rig Pin Kit
Freeplay Indicator-Dial

8. ANALYST'S COMMENTS: (Continued)

measurements. Then a curve must be drawn and compared to curves in the maintenance manual. Although this detail is well within the organizational abilities, it is far too exacting and time consuming to be used on the flight line. Rather, ranges or tolerances for up and down loads should be given and the graphing eliminated. Additionally, the Freeplay Load Measuring Fixture requires a minimum of 80 pounds of sandbags or equivalent be placed on it. This additional weight should be compensated for by either supplying the weights with the GSE or designing a base to compensate for the uploads to be applied to the elevator.

NOMENCLATURE: Outer Wing LE Inboard Flap
PHOTO ID NO.: 129

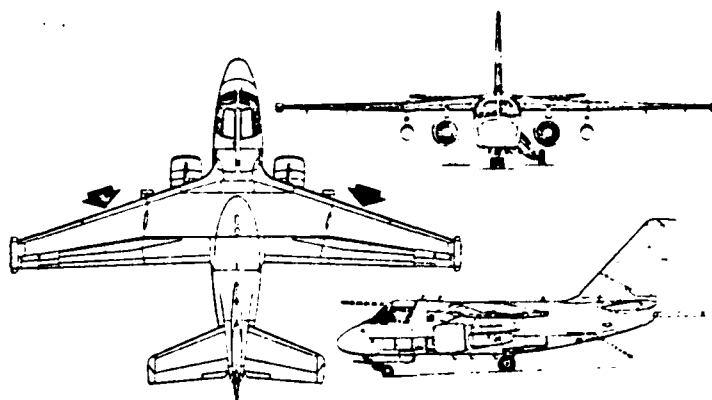
WORK UNIT CODE: 14722
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Wing outer panel, leading edge

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric
☒ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 8 panels with the following quantities of high-torque screws
8, 11, 6, 9, 5, 6, 4, 5.

5. REMOVAL: 1. Disconnect LE de-ice ducting (3 setscrews, bonding wire, nut).
2. Disengage de-ice ducts.
3. Disconnect connecting link (2 bolts, nuts, cotter keys); electrical connector.
4. Remove bonding wires (2), safety cable.
5. Remove bolts (2), remove flap.
6. Remove de-ice components.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☒ Hydraulic
Access Required: ☒ Airconditioning
Test Equipment Required: Portable CLA test set, Proximity switch indicating set
Actions: 1. Perform operational check of flap.

8. ANALYST'S COMMENTS: This component installation is about standard for wing leading edges. Access to hinge points and connecting links requires removal of a substantial number of panels. An improvement could be made by decreasing the quantity of panels. A strong feature of the installation is the fact that the leading edge can be removed in any position.

It is difficult working around the hinge bolts because of a lack of working space and rigging linkages corrode, frequently requiring additional effort to loosen.

NOMENCLATURE: Wing Flap Assembly
PHOTO ID NO.: 62

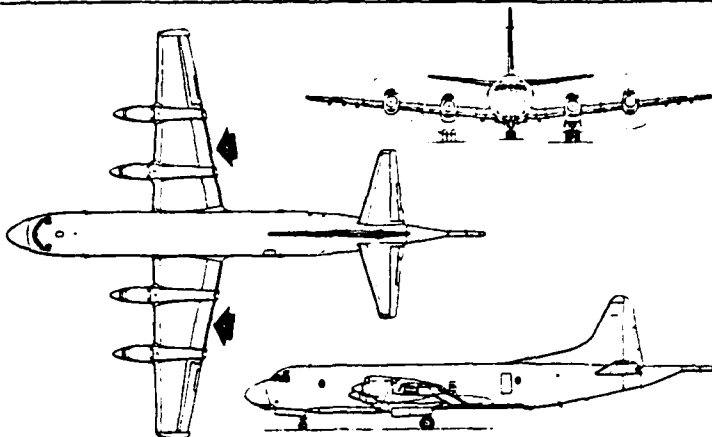
WORK UNIT CODE: 1491L
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Wing trailing edges

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Gage, Flap Extension
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: 7 Access panels (2 screws each)

5. REMOVAL: 1. Disconnect assembly detector cable (2 screws), carriage tie rods.
2. Run flaps down, disconnect actuator (2 bolts, 2 bushings).
3. Disconnect carriages (5) (7 bolts each).
4. Remove flap assembly.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform wing flap operational check.
2. Check clearance, flap stops and flap symmetry.

8. ANALYST'S COMMENTS: This is a relatively straightforward installation. Access is very good to all attachments. There are many carriage connection points which need disassembly but this is to be expected on such a large, heavy (150 pound) piece of structure. Carriage attachment points could be improved to reduce the number of bolts required to hold it together. The rigging gage used to measure flap extension is outstanding and is simple to use. It is a thin aluminum strip with a hook on the end.

This is the easiest surface to work on despite the fact that the actuator bolt has a keyway with a thin head on it which is hard to grasp with tools.

NOMENCLATURE: Inner Wing Landing Flap
PHOTO ID NO.: 64

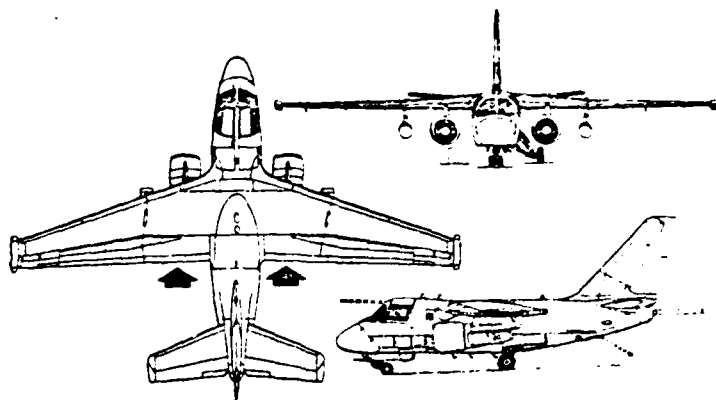
WORK UNIT CODE: 1481C
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Wing, trailing edge, inboard

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric
☒ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 4 panels with the following quantities of high-torque screws: 11, 15, 17, 25. Open 2 panels with the following quantities of Camloc fasteners:

5. REMOVAL: 1. Remove fairings from wing carriages (24 screws).
2. Disconnect links (2).
3. Remove flap stops (2 screws), slide flap off.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required: (See continuation sheet)

Actions: 1. Cycle flaps.
2. Perform operational check.

8. ANALYST'S COMMENTS: This is a good installation. Although the flap is large and requires three people to remove, the operation is relatively simple with good access to attach points. The only drawbacks are the extensive rigging checks required and the large quantity of GSE needed to check the flap system out. The amount of support equipment required should be minimized.

NOMENCLATURE: Inner Wing Landing Flap

WUC: 1481C
AIRCRAFT: S-3A

7. FUNCTIONAL CHECK: (Continued)

- Test Equipment Required:
1. Anti-skid breakout box.
 2. TE flap damper test cable.
 3. Flap actuator assembly test set.
 4. Adapter, Flap actuator clutch shaft.

NOMENCLATURE: Aileron Assembly
PHOTO ID NO.: 63

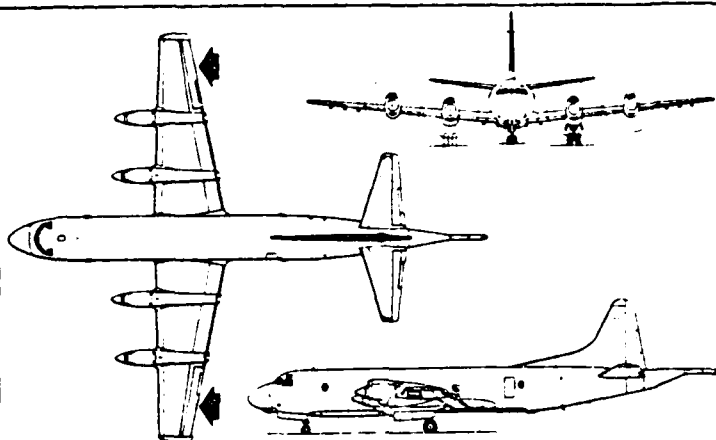
WORK UNIT CODE: 1421A
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Wings, outer trailing edge

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: 6 Panels (31 quick release fasteners, 1 screw)

5. REMOVAL: 1. Disconnect aileron tab cables, push pull rod (1 bolt, stop nut).
2. Remove wingtip.
3. Remove four bonding wires.
4. Remove four mounting bolts (1 with nut and cotterkey, 3 with clips).

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☒ Hydraulic
Access Required: 2 Panels (camlocs)
Test Equipment Required:
Actions: 1. Perform operational check of flight control surfaces.
(Check neutral position and asymmetry.)

8. ANALYST'S COMMENTS: The wing tip has to be removed in order to remove the aileron. This additional step makes this installation most untenable from a maintainability point-of-view. Removal of the aileron should not require removal of any other structure but the aileron. Removal of the wing tip disturbs exterior lighting and ECM systems, which must be exercised upon re-installation of the wing tip.

NOMENCLATURE: Aileron Assembly
PHOTO ID NO.: 128

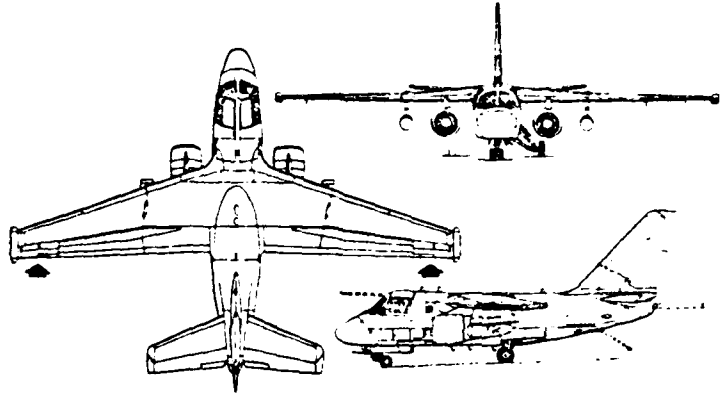
WORK UNIT CODE: 1432
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Wing, outer panel trailing edge

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Rig Pin Kit
☒ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open 10 panels with the following numbers of high-torque screws: 30, 18, 3, 2, 4, 11, 12, 8, 11, 33. Open 4 panels with following numbers of Camloc or Deutsch quick release fasteners: 15, 26, 14, 9.

5. REMOVAL: 1. Remove three bond wires (2 bolts each).
2. Disconnect connecting links (2 bolts).
3. Remove bolts from three hinges (1 bolt each).
4. Remove aileron.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☒ Rig ☒ Adjust ☐ Service ☒ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Perform operational check of aileron to check for binding.

8. ANALYST'S COMMENTS: This is a very good installation. Its only drawback is the number of panels required to be removed. Bolts are easy to get to and the rigging is simple, though time consuming.

NOMENCLATURE: C-8789/ASW-33 Aircraft Control Stick
PHOTO ID NO.: 26 (Pilot's depicted)

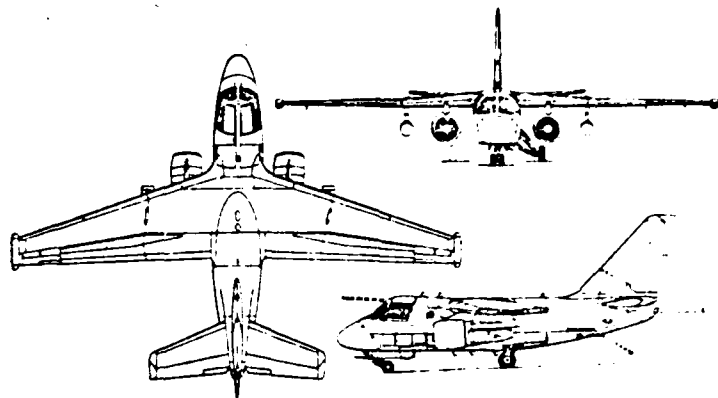
WORK UNIT CODE: 5736A
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Cockpit.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Pilot's:
 a. Extend upper control stick shaft.
 b. Disconnect electrical connector.
 c. Remove nut and bolt securing control stick to shaft.
 d. Lift and remove control stick.
2. Copilot's:

(see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. AFCS functional check required.

8. ANALYST'S COMMENTS: A good, simple installation marred by slight differences in the remove and replace procedures and the use of loose nuts rather than captive.

NOMENCLATURE: C-8789/ASW-33 Aircraft Control Stick

WUC: 5736A
AIRCRAFT: S-3A

5. REMOVAL: (Continued)

- a. Disconnect electrical connector.
- b. Remove 3 screws from cover.
- c. Raise cover.
- d. Remove nut and bolt securing control stick to shaft.
- e. Lift and remove control stick.

UTILITY SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Auxiliary Power Plant	24210 .	24100 .
Cabin Temperature Control	41150 .	4113F .
Generator Control/Supervisory Panels	42113 .	42114 .
Exterior Lights	44124 .	44121 .
	44126 .	44132 .
	44127 .	44151 .
Reservoir (PC or Flight Control)	45121 .	45214 .
Liquid Oxygen Converter	N/A	47111 .

SYSTEM: UTILITY

• *AUXILIARY POWER PLANT:*

The auxiliary power plant (APP) installations are characterized by optimum packaged units fitting into tight spaces. Both the P-3C and S-3A units must be maneuvered into position carefully to avoid damage to adjacent components or to components on the auxiliary power plant. The S-3A APP is considerably smaller than its P-3C counterpart and is inserted (slid) into position by use of a built-in compartment rail. This is a good feature as it relieves the weight of the unit and any required stabilizing from the maintenance technician. Both units have duct clamp and hose connection problems. Consideration should be given during design to increasing the available space around the unit to facilitate connections. The auxiliary power plant starter on the P-3C frequently fails and replacement requires removal of the entire auxiliary power plant. Designers should package the unit in such a manner that the major components or the lower reliability components may be individually replaced.

• *CABIN TEMPERATURE CONTROL:*

Very little need be said about the cabin temperature control installations. Both designs are very good as far as the control panel is concerned. They are mounted in the center consoles by a minimum number of fasteners. The S-3A panel lifts out with plenty of connector cable length. The P-3C panel swings out and access to connectors is outstanding. The P-3C gages can be taken out individually without the need to swing the entire unit out, a point worth repeating in new designs. Both use all electrical switches as opposed to pneumatic or a combination. Electrical control systems are preferable from a maintenance standpoint because of their simplicity.

• *GENERATOR CONTROL/SUPERVISORY PANELS:*

Access to these units is good due to the space available in the airplanes. Cable length and connector disconnect room is also good. The mounting of both units is poor. The P-3C mounting screws insert from the bottom of the unit, making removal and installation blind. The S-3A uses four bolts, the aft two nearly impossible to reach. In such cases the use of a passive retainer such as a sheet metal lip flange would alleviate tool room inadequacies. The supervisory panels on the P-3C are mounted beside one another which allows swapping of electrical connectors to aid in troubleshooting, a strong feature.

• *EXTERIOR LIGHTS:*

Position and anti-collision lights are combined under this heading because of similarity among aircraft. Light assemblies are simple from the technician's point-of-view and provide problems mainly in the locations required to perform their function. The position/formation lights on both aircraft are easy to maintain and to replace bulbs. All use a bayonet lamp which facilitates maintenance. The P-3C aft formation light uses six screws to hold the lens in place, which is considered excessive for this installation. The S-3A aft position light is hard to service at sea because of its location and the unavailability of sturdy space to stand on because the airplane tail sits out over the edge of the deck.

The anti-collision lights each presented its own unique problems. The P-3C uses a strobe lamp which eliminates the mechanical components required in rotating beacons as the S-3A uses. But the P-3C uses a high capacitance discharge power supply which requires safety steps be performed prior to replacing the lamp. While strobe flashers are preferred because of their simplicity and greater luminescence, their improved maintainability characteristics are negated unless designs preclude the necessity for additional safety steps. The S-3A anti-collision lamp uses a plug in lamp. Insertion or removal requires a special tool and, even with this, replacement is difficult. Although the upper light is in a high vibration area requiring a secure fit, it should not be so tight that it is very difficult to remove.

- ***RESERVOIR (PC OR FLIGHT CONTROL):***

Removal and replacement of this component is easier in the P-3C and S-3A than in most other Naval airplanes. Access to the reservoirs is generally good. Both are located in large compartments. The P-3C is very easy to maintain due to its accessible hydraulic fittings and its two strap/band type mountings. It is mounted well above the floor, providing the hand/tool room needed. The S-3A reservoir is mounted closer to the floor and some of the fitting and mounting bolts are hard to disconnect or remove. The S-3A reservoir gage extends into the wheel well so personnel can check its level without having to gain further access. This is a good feature, but designers should note that the gage should be replaceable without requiring complete reservoir removal. Bleeding and servicing are critical aspects of this installation and designs should minimize maintenance steps required to accomplish these efforts.

- ***LIQUID OXYGEN CONVERTER:***

The S-3A liquid oxygen converter is a standardized, GFE item and is used throughout the Navy. It is very accessible and quickly disconnects from its connectors and mounting. The P-3C does not use a converter.

NOMENCLATURE: Auxiliary Power Plant
PHOTO ID NO.: 149

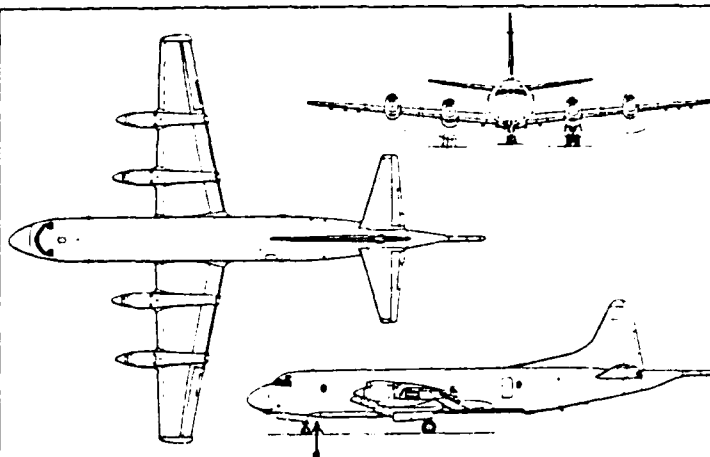
WORK UNIT CODE: 24210
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Forward fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Bomb Trailer, MK-7,
☐ Hydraulic Mod 1

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open and remove compressor air intake maintenance door (1 retaining pin, 26 camlocs), APU service doors (2) (42 camlocs), disconnect electrical connectors (2).

5. REMOVAL: 1. Disconnect electrical connectors (6), oil scupper tank drain, fuel drain hoses.
2. Remove air inlet plenum, fuel supply inlet line, marmon clamp, exhaust duct heat shield.
3. Unfasten flare arrestor, loosen primary exhaust duct V clamp, rotate aft oil drain valve for clearance.
4. Position bomb trailer and remove mounting bolts (4).

6. INSTALLATION: ☒ Reverse Of Removal

Torque 3 bolts

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☒ Other (Specify): Bleed fuel control

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required: APU Analyzer

Test Equipment Required:

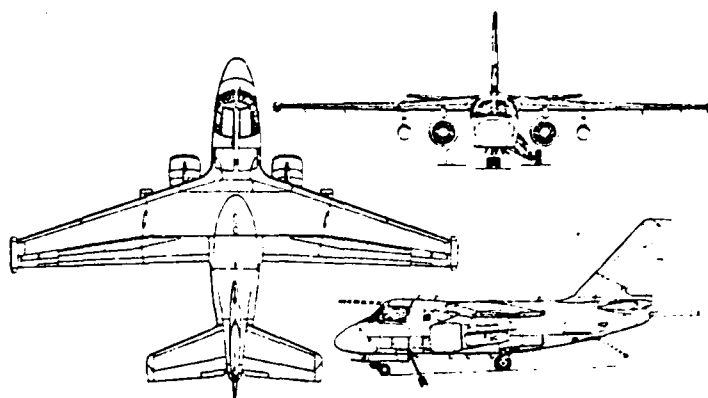
Actions: 1. Turn-up APU and check for leaks (air, exhaust, fuel).

8. ANALYST'S COMMENTS: This installation can best be described in one word - tight. Clearance on the forward and aft edges of the APU are slight, creating problems installing the unit. Squadron personnel also have problems working on exhaust duct clamps because of insufficient room for hands and tools. Mounting bolts for the APU are accessible. The bomb trailer and APU adapter are very maneuverable and help ease some of the tight fit problem during installation. One of the biggest problems with the APU is the starter. The starter cannot be repaired in place and to remove it requires removal of the whole APU, a serious drawback.

NOMENCLATURE: WRC27 Auxiliary Power Unit
PHOTO ID NO.: 67

WORK UNIT CODE: 24100
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Forward fuselage, port side
2. SUPPORT EQUIPMENT:
- | | |
|--|---|
| <input type="checkbox"/> None | <input type="checkbox"/> Hoist/Sling |
| <input type="checkbox"/> Workstand | <input type="checkbox"/> Jacks |
| <input type="checkbox"/> Power (Type) | <input type="checkbox"/> Service (Type) |
| <input checked="" type="checkbox"/> Electric | |
| <input type="checkbox"/> Hydraulic | |
3. PREPARATION:
- | | |
|---|--|
| <input type="checkbox"/> Fuel/Defuel | <input type="checkbox"/> Safety Steps |
| <input type="checkbox"/> Other (Specify): | <input type="checkbox"/> Jack Aircraft |



4. ACCESS/CLOSE UP: Open APU access door (9 quick release fasteners, 1 screw).
Open one panel (1 latch).
Open bomb bay doors.

5. REMOVAL:
1. Dump start valve package (bomb bay).
 2. Disconnect plug connector, disconnect and remove air duct coupling.
 3. Disconnect center mounting bolt, bond wire.
 4. Disconnect drain tube, fuel hose, 2 hydraulic lines.
 5. Loosen main mounts (2), slide APU out on rails.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☒ Hydraulic
Access Required: ☒ Airconditioning
Test Equipment Required:
Actions: 1- Press test button on cockpit panel.
2. Perform functional check of APU and monitor BIT indicators.

8. ANALYST'S COMMENTS: This is a compact unit which fits into an equally small space. The unit slides into the mounting space on rails, a very good feature. However, plumbing connections on the bottom of the compartment frequently catch on the APU as it slides in and out. Designs should ensure plumbing does not extend into the path of the APU. (One squadron uses a skid plate.) In practice the bleed air clamp requires a non-standard box-end ratchet to remove because open end ratchets are hard to get on the hardware. The hydraulic supply quick disconnects require two hands to secure and that is difficult. The purpose of quick disconnects is to facilitate connections. So they should be placed in an area where there is sufficient hand room.

NOMENCLATURE: Temperature Control System
PHOTO ID NO.: 147, 161, 162, 163

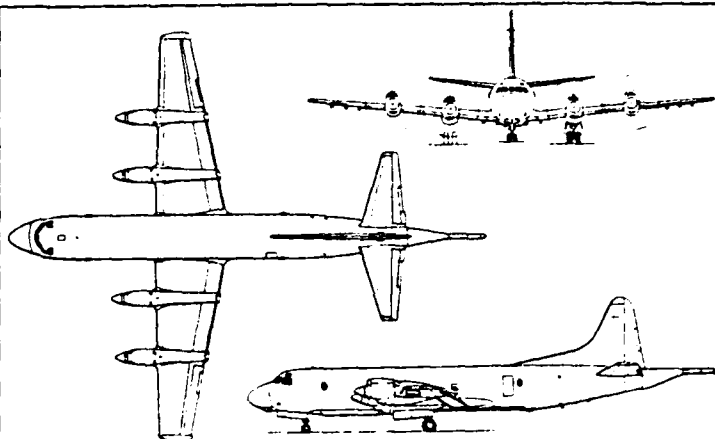
WORK UNIT CODE: 41150
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Cockpit

2. SUPPORT EQUIPMENT:

- ☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: One panel (18 captive screw fasteners)

5. REMOVAL: Control panel. (Photo 162)

1. Remove four screws and swing panel out.

Indicating gages on control panel. (Photo 147)

1. Remove screw and slip out; disconnect electrical connector.

Control boxes (Photo 161)

1. Gain access to electrical relay compartment (behind co-pilot).

(See continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required: B092 test set

Actions: 1. Perform operational test using test set.

8. ANALYST'S COMMENTS: Access to the control panel and indicating gages is outstanding. Very little can be done to improve these designs. The ability to remove the gages without having to swing out the panel is very good. Also, these gages have plenty of wire length on the connectors to allow disconnection from the front of the panel. The toggle switches on the panel require the lucite panel (2 screws) be removed to gain access to the mounting hardware.

The control box replacement is not as easy. They are located in a small access space with many high-voltage relays. Work on this part of the system requires power to be off the aircraft. Access to the lower bolts on the bottom box is poor and is hampered by its proximity to a high voltage relay lead.

(See continuation sheet)

NOMENCLATURE: Temperature Control System

WUC: 41150

AIRCRAFT: P-3C

5. REMOVAL: (Continued)

2. Disconnect cannon plug.
3. Remove mounting screws (4).

8. ANALYST'S COMMENTS: (Continued)

Squadron personnel indicate the B092 test set works well and, with it, they are able to isolate to the component level.

NOMENCLATURE: Environmental Control Panel
PHOTO ID NO.: 108,109

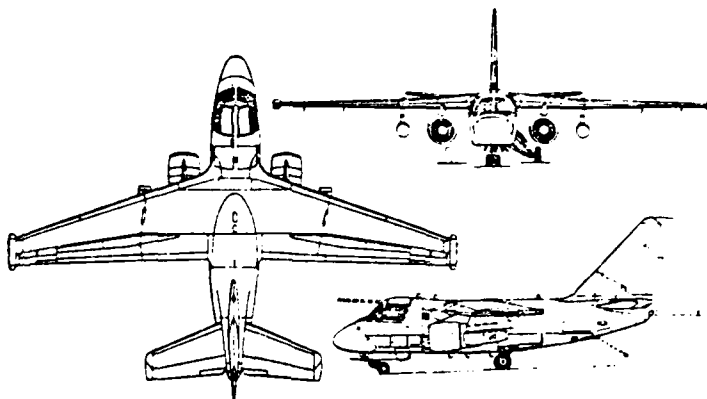
WORK UNIT CODE: 4113F
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Cockpit, upper center console

2. SUPPORT EQUIPMENT:

- ☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Disconnect four DZUS fasteners.
 2. Disconnect five cannon plugs.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Turn on APU.
 2. Check hot and cold indications in manual and auto modes.

8. ANALYST'S COMMENTS: This is an outstanding installation. The removal is simple with plenty of pigtail length on the connectors. The use of electrical connectors instead of pneumatic switches and connectors precludes control air system leaks and their ensuing system problems.

NOMENCLATURE: Supervisory Panel (#2 Engine)
PHOTO ID NO.: 46

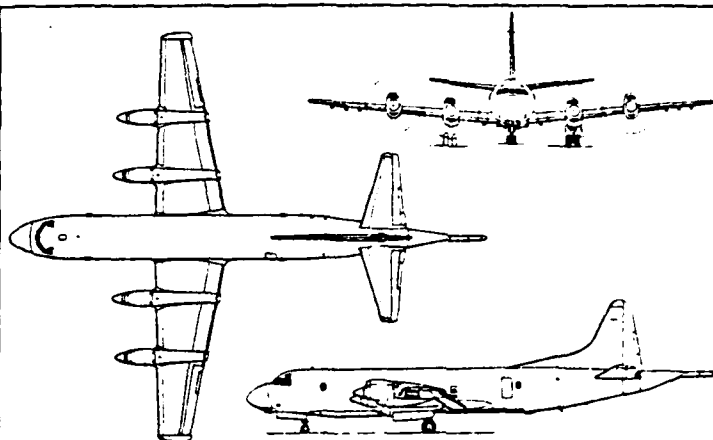
WORK UNIT CODE: 42113
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Main Electrical Load Center

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: To gain access from aisle, remove applicable access panel from main electrical load center (10 DZUS fasteners).

5. REMOVAL: 1. Remove electrical connector.
2. Remove 4 Allen head screws from base of unit.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

Prior to installation check rotating diode. Requires 6 volt battery and multimeter.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1: Accomplish electrical system functional check.

8. ANALYST'S COMMENTS: This is a fair installation, primarily due to location of the mounting screws (underneath unit). Physical positioning of the panel is considered excellent since a faulty unit may be isolated by swapping electrical connectors between supervisory panels, which are located adjacent to each other.

NOMENCLATURE: Generator Control Unit
PHOTO ID NO.: 32

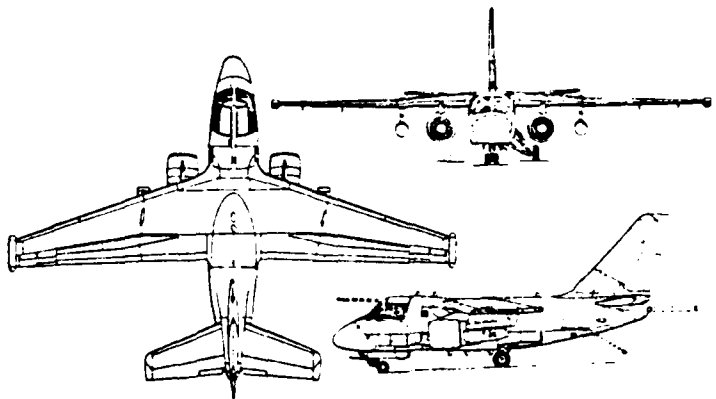
WORK UNIT CODE: 42114
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Below #1 and #2 circuit breaker
panels. (LH and RH)

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Remove aisle access panel (Velcro fastening) and open left or right hinged circuit breaker panel.

5. REMOVAL: 1. Disconnect electrical connector.
2. Remove 4 bolts, (unit is hard mounted to floor.)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. Turn up left, right or both engines as applicable.
2. Insure buss transfers.
3. Run BIT.

8. ANALYST'S COMMENTS: A simple installation complicated by the use of four mounting bolts. Accessibility to the rear bolts is limited and requires opening of a circuit breaker panel. A sheet metal lip retainer assembly under which the rear mounting bracket could be seated would negate the need to use bolts in the rear and to open the circuit breaker panel. Organizational level personnel reported that BIT indicators are not dependable.

NOMENCLATURE: Formation Lights, Aft
PHOTO ID NO.: None

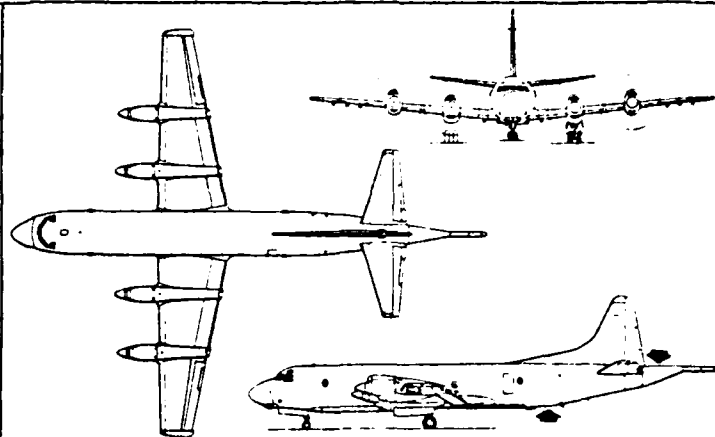
WORK UNIT CODE: 44124
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
MAD boom area

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove screws (6), electrical connector (1).
2. Replace bulb.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1. Perform operational check of bulb.

8. ANALYST'S COMMENTS: A simple straightforward installation, it could be improved by reducing the number of screws.

NOMENCLATURE: Wing Position Lights
PHOTO ID NO.: 20

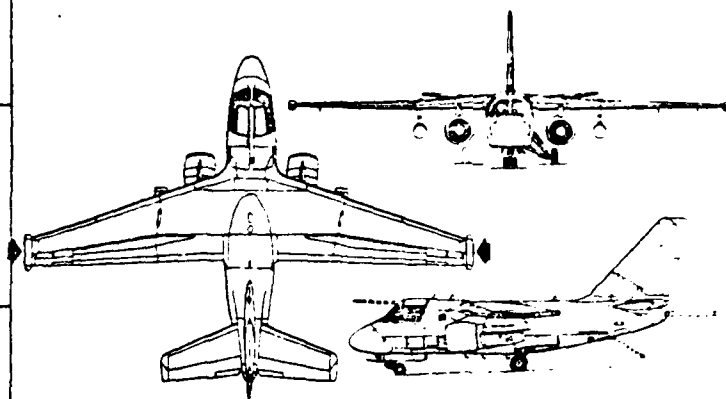
WORK UNIT CODE: 44121
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
LH and RH wing tip pod, outboard side.

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove 3 lens screws, remove lens. (2 Phillips, 1 High-Torque.)
2. Remove lamp.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements:

☒ Electric

☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. Position wing switch to BRIGHT.
2. Master exterior lights switch to ON.
3. Verify wingtip position lights are on.

8. ANALYST'S COMMENTS: Only problem is accessibility to left wingtip with wings folded. Otherwise it is a good installation.

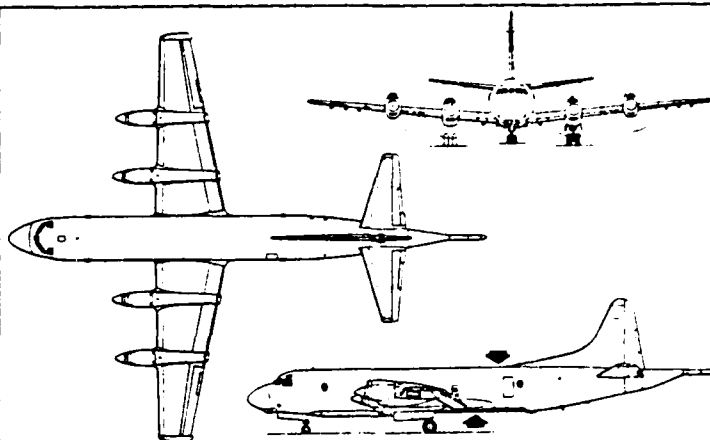
NOMENCLATURE: Anti-Collision Lights
PHOTO ID NO.: 146

WORK UNIT CODE: 44126
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center fuselage, upper
Aft fuselage, lower

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Disconnect aircraft input cable P2, open circuit breakers (2).
2. Remove connector plugs from power supply.
3. Loosen drawband (1 screw) around lens assembly, remove lens assembly.
4. Remove retaining screws (3) from base of lamps. Remove red and white strobe lamps.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Turn on lights.

8. ANALYST'S COMMENTS: This is a good installation. The assemblies are easy to get to and lamps may be removed from either inside or outside the aircraft. (Inside removal requires removing eight screws instead of one drawband screw). Because of the nature of lamps, safety steps must be taken to avoid electrical shock by the high capacitance of the power supply. Additionally, care must be taken to avoid use of lamp assemblies without lens assembly to prevent ultraviolet light damage to eyes.

NOMENCLATURE: Tail Position Light
PHOTO ID NO.: 20

WORK UNIT CODE: 44132
AIRCRAFT: S3A

1. LOCATION: (Indicate)

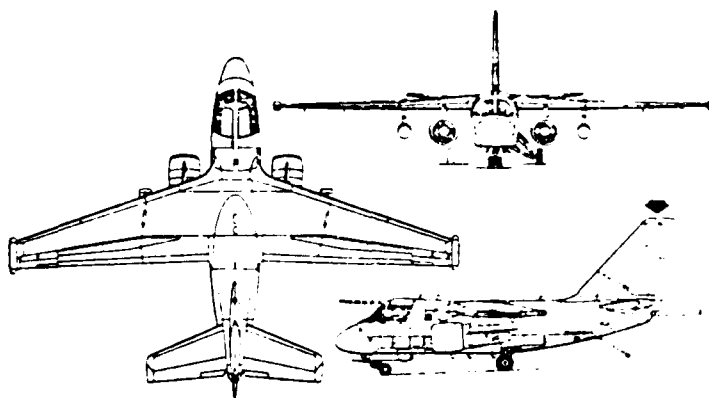
Upper section of tail cone

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION:

☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove lens and retainer (3 phillips head screws).
2. Remove lamp.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

- Actions: 1. Position Tail switch to BRIGHT.
2. Master exterior lights switch to ON.
3. Verify tail position lamp comes on.

8. ANALYST'S COMMENTS: Except for accessibility, particularly on a carrier, this appears to be a good installation. However, organizational level personnel report that the lamp is secured with a metal locking collar, necessitating the removal of the entire cone assembly to affect replacement of the lamp.

NOMENCLATURE: Formation Lights, Wing Tip
PHOTO ID NO.: 148

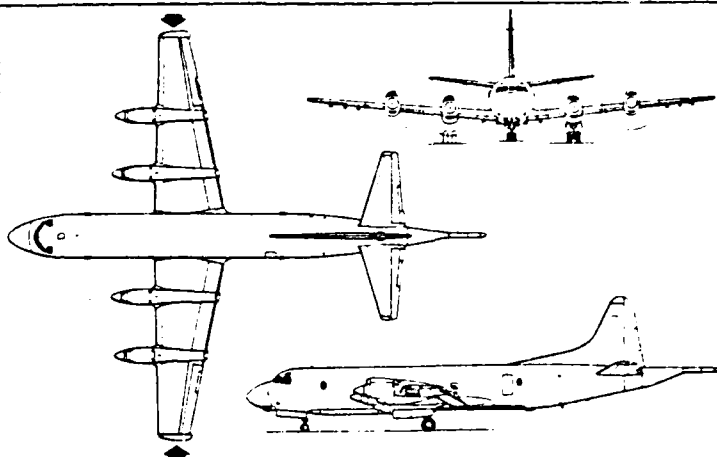
WORK UNIT CODE: 44127
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Wing tips

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove screws (2) and lens.
2. Remove bulb.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1- Turn light on.

8. ANALYST'S COMMENTS: This is a standard wing tip light installation and is very easy to maintain.

NOMENCLATURE: Anticollision lights
PHOTO ID NO.: 20

WORK UNIT CODE: 44151
AIRCRAFT: S3A

1. LOCATION: (Indicate)

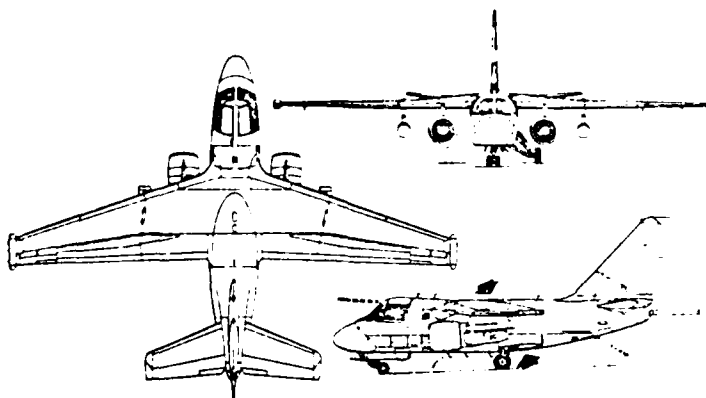
Upper - Fwd tip, vertical fin
Lower - FWD of bomb bay on
centerline.

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Lamp Extraction/
☐ Hydraulic Insertion Tool.

3. PREPARATION:

☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: Upper and Lower:

1. Remove lens (1 Phillips head screw with gasket).
2. Push lamp extraction/insertion tool onto lamp.
3. Remove lamp.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

- Actions:
1. Position anticollision switch to BOTH.
 2. Master exterior lights switch to ON.
 3. Verify that both anticollision lights operate.

8. ANALYST'S COMMENTS: Accessibility to the upper anticollision light poses a problem, particularly shipboard. Maintenance personnel must fold the fin to gain access. With the fin folded, maintenance personnel can reach the light assembly by standing on the horizontal stabilizer. However, the available foothold is precarious at best.

NOMENCLATURE: Main Hydraulic Reservoir
PHOTO ID NO.: 157

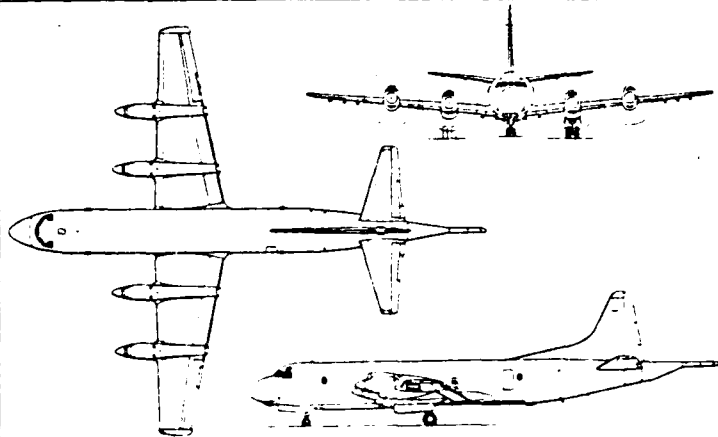
WORK UNIT CODE: 45121
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center fuselage, bottom

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Bucket
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open lower aircraft access door (handle).
(door slides out of way on rails)

5. REMOVAL: 1. Remove cap from top of reservoir (loosen one band).
2. Drain reservoir.
3. Remove lockwire between two reservoirs.
4. Cut lockwire and disconnect cannon plug.
5. Disconnect 4 hydraulic lines (stainless steel B-nuts).
6. Loosen 2 screws on installation clamps and remove reservoir.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1. Pressurize system and check for leaks.
2. Check gage on reservoir and gage in cockpit for proper indications.

8. ANALYST'S COMMENTS: This is a good installation. Access is excellent for the reservoir and the fittings. Use of metal "V" bands facilitates removal and installation. The drain cock is easy to use and is spring loaded. It was noted that most of the problems are with different indications between cockpit and reservoir gages. This difference between gages generally requires changing the electrical indicating system and not the entire reservoir. The pressure gages on the bottom front of the reservoir could be subject to damage.

NOMENCLATURE: 5.8 Gallon No. 1 System Hydraulic Reservoir
PHOTO ID NO.: 118

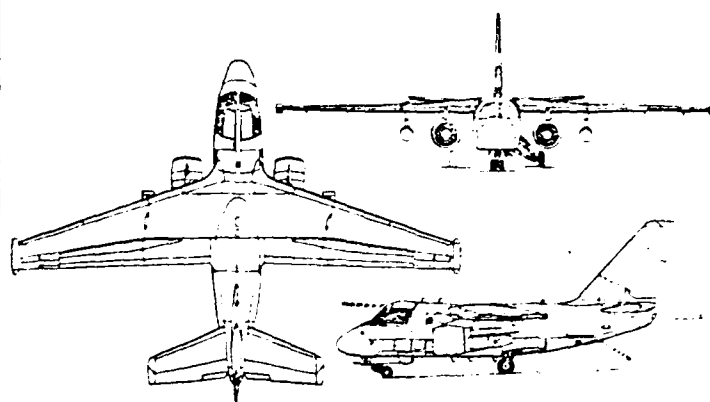
WORK UNIT CODE: 45214
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Inside ECS compartment above
LH wheel well

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Hydraulic Adapter
☒ Hydraulic Kits (2)

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Drain reservoir, remove bleed hose adapter.
2. Disconnect electrical connector, loosen 5 hydraulic lines.
3. Remove mounting bolts (4).
4. Remove hydraulic line, disconnect 4 hydraulic lines.
5. Remove reservoir.

6. INSTALLATION: ☒ Reverse Of Removal

1. Fill high pressure side of reservoir prior to installation.

After Installation Actions: ☒ Bleed ☐ Rig ☐ Adjust ☒ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☒ None

Power Requirements: ☐ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: -

8. ANALYST'S COMMENTS: The reservoir is located in the ECS compartment. Working space is fair when standing in the compartment door but cramped with the door closed. Mounting bolts are difficult to install because of lack of finger room. Several hydraulic lines are also difficult to work on because of lack of hand/tool room. Repositioning of these lines would alleviate the problem and make the reservoir easier to remove. The bleeding procedures are long and time consuming but not difficult.

The greatest problem occurs with the indicating gage. This gage sticks through the compartment floor into the wheel well for reading, a good feature. But the gage usually fills with hydraulic fluid and repair or replacement requires the complete well to be taken out. This is a disadvantage.

NOMENCLATURE: GCU 24A LOX Converter
PHOTO ID NO.: 68

WORK UNIT CODE: 47111
AIRCRAFT: S-3A

1. LOCATION: (Indicate)

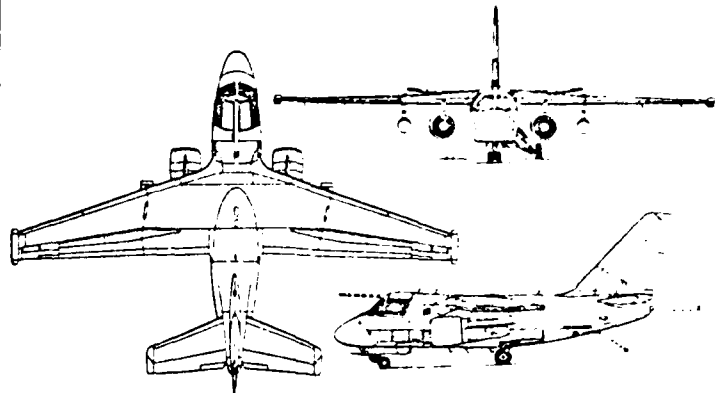
Forward Fuselage, Starboard side,
next to personnel door

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric (See continuation
☐ Hydraulic sheet)

3. PREPARATION:

☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open LOX compartment (2 latches).

5. REMOVAL: 1. Disconnect electrical connectors (2).
2. Disconnect quick disconnect oxygen lines (2).
3. Unscrew mounting wing nut, remove converter.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Bcresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required:

Actions: 1.- Check LOX quantity indicator.

8. ANALYST'S COMMENTS: This is a standard Navy installation. The latches on the access door are outstanding. They are quick release fasteners about one inch round on the release side and 3/8 inch round on the engage side. They require no tools and are easy to operate. NARF engineers indicated as good as the latches are, they are occasionally popped open by air loads, causing the doors to be lost inflight. Using a stiffer spring would alleviate this problem.

NOMENCLATURE: GCU 24A LOX Converter

WUC: 47111

AIRCRAFT: S-3A

2. SUPPORT EQUIPMENT: (Continued)

- Face Shield
- Hard Cloth Coveralls
- Leather Gloves
- LOX Boots
- Rubber Apron
- Rubberized Spats

AVIONIC
SYSTEMS

INSTRUMENT SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Aircraft Flight Instruments	51115 .	51112 .
	51117 .	51113 .
	51331 .	51341 .
	51511 .	51512 .
	73134 .	

SYSTEM: INSTRUMENTS

- **GENERAL COMMENTS:**

Four cockpit instrument installations were studied in each aircraft. All were panel or console mounted and the roominess of the cockpit interiors should have resulted in excellent accessibility to effect the required maintenance actions. However, in the case of the S-3A, other equipments or furnishings had to be removed in order to facilitate the removal/installation action.

- **ALTIMETER/AIRSPEED INDICATORS:**

Both aircraft utilize standard mounting and connection methods consisting of Phillips head screws, electrical cable connectors and pneumatic hose fittings. Problems are encountered whenever cable or hose length provides insufficient slack to allow the indicators to clear the instrument panel and permit access to the connectors/pneumatic fittings. Even when the cables/hoses are originally designed to provide sufficient slack, repairs to cables or connectors, changes in clamping or routing, or modifications to the indicator/mounting can contribute to losses in available slack and force the technician to find alternate means of gaining access to the connectors/fittings. Use of rack and panel type installations would do much to solve this problem.

- **FUEL FLOW/QUANTITY INDICATORS:**

The requirement for an engine run to verify serviceability of a fuel flow indicator turns a simple routine maintenance task into an expensive, time consuming, major operation. This is unsatisfactory. Maintainability requirements dictate that an alternate means of checkout is needed. The master instrument test check built into the F-14 provides this alternate capability. A need exists now for a test set, compatible to all Navy aircraft, to operationally check engine instrumentation without requiring an engine turn. The cost of design would be offset by the manpower and material savings effected by voiding the need for an engine run.

NOMENCLATURE: Max Allowable Airspeed Indicator
PHOTO ID NO.: 33

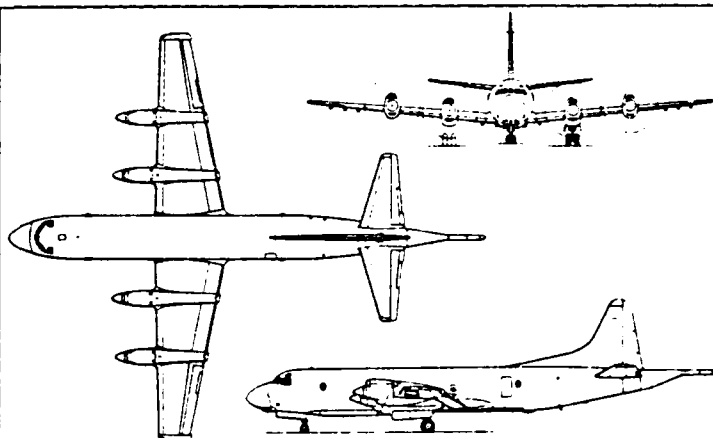
WORK UNIT CODE: 51115
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Pilot's and Copilot's instrument
panels

2. SUPPORT EQUIPMENT:

- ☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove light cowl assembly (2 screws).
2. Remove 3 Phillips screws from face of indicator.
3. Disconnect 2 pneumatic hoses.
4. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions. ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required: TTU-205

Actions: 1. Check for leaks.

2. Accomplish functional check assuring compatibility between pilots and co-pilots indicators and agreement with test set readings.

8 ANALYST'S COMMENTS: Organizational level maintenance personnel report that hoses to the indicators are shorter in some installations than in others. This probably occurs due to slight changes in routing/clamping of the hose assembly. However, whenever the lines are too short to allow the indicator to clear the instrument panel for disconnect, the tendency is to stretch the lines until sufficient clearance is obtained to permit use of a wrench to disconnect the lines.

NOMENCLATURE: Airspeed and Mach Number Indicator
PHOTO ID NO.: 107

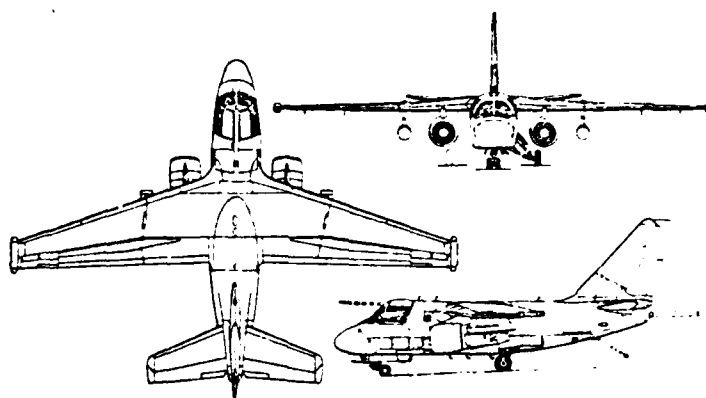
WORK UNIT CODE: 51112
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Pilots and copilots instrument
panels

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove ID-1780, Attitude Course Height Deviation Indicator, (VDI) to gain access.
2. Remove light cowl (2 screws).
3. Remove 3 Phillips head screws from face of instrument.
4. Disconnect electrical connector and pitot and static lines.
5. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements:

☒ Electric

☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: TTU-205

Actions: 1. Accomplish airspeed and Mach number indicator functional check.
2. In Flight Evaluation (IFE) required.
3. Functionally check the VDI.

8. ANALYST'S COMMENTS: Requirement to remove the VDI detracts from an otherwise clean installation. (Light cowls are not utilized on all installations.) Use of a properly functioning TTU-205 should preclude the need for an IFE.

NOMENCLATURE: AAU21/A Counter Drum Altimeter
PHOTO ID NO.: 34

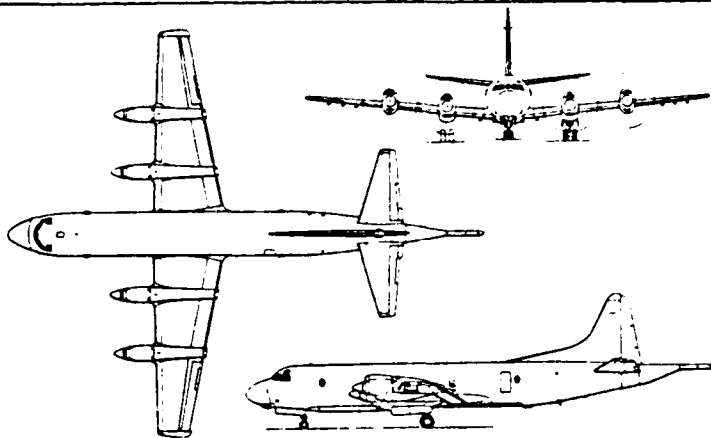
WORK UNIT CODE: 51117
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Pilot's and Copilot's instrument
panels

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL:
1. Remove 3 Phillips screws.
 2. Disconnect 1 connector.
 3. Disconnect 1 pneumatic hose.
 4. Remove instrument.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required:

Test Equipment Required: TTU-205

Actions: 1. Check for leaks.

2. Functional check assuring compatibility between Pilots and Copilots
indicators and agreement with test set readings.

8. ANALYST'S COMMENTS: Removal and replacement are routine maintenance actions.
No problems.

NOMENCLATURE: AAU-19/A Counter Drum Altimeter
PHOTO ID NO.: 30

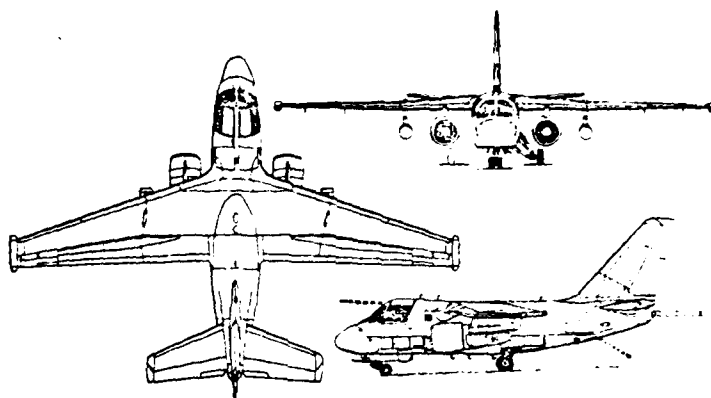
WORK UNIT CODE: 51113
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Pilots and Copilots instrument
panels.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove the HSI or BDI to gain access to pneumatic line.
2. Remove 4 Phillips head screws.
3. Disconnect electrical connector and static fitting.
4. Remove Altimeter.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: TTU-205

Actions: 1. Perform barometric altimeter indicator functional check.
2. Requires In Flight Evaluation (IFE).
3. Functionally check the HSI or BDI as applicable.

8. ANALYST'S COMMENTS: Organizational level personnel were specific when citing the need to remove the BDI or HSI in order to disconnect the pneumatic fitting. This could be due to alterations in routing of the pneumatic line after initial installation, or to slight variations in line length. In either case, the condition is unsatisfactory.

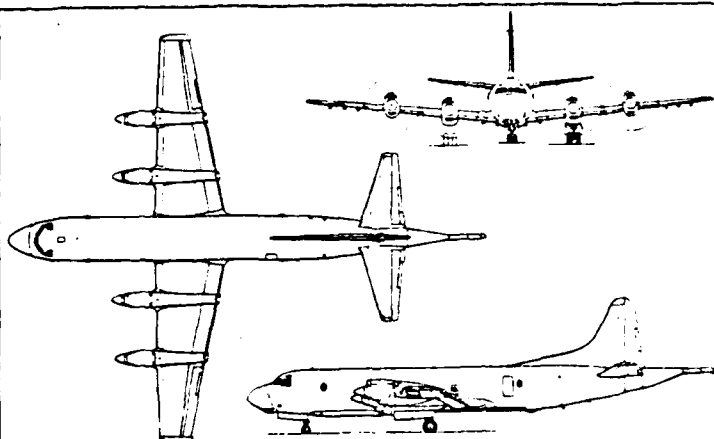
NOMENCLATURE: Engine Fuel Flow Indicator
PHOTO ID NO.: 36

WORK UNIT CODE: 51331
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center instrument panel.

2. SUPPORT EQUIPMENT:
☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Loosen 1 Phillips head screw. (Frees indicator, which is secured by clamp.)
2. Remove electrical connector.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☐ Electric ☐ Hydraulic
Access Required: Cockpit
Test Equipment Required:
Actions: 1.- Accomplish functional check in conjunction with engine run.

8. ANALYST'S COMMENTS: This is a good installation.

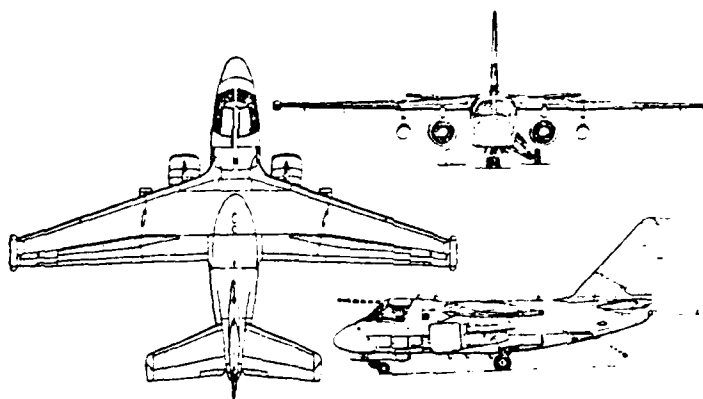
NOMENCLATURE: EFU-41/A Fuel Flow Indicator
PHOTO ID NO.: 28

WORK UNIT CODE: 51341
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Center instrument panel

2. SUPPORT EQUIPMENT:
☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Remove 4 Phillips head screws from face of indicator.
2. Remove glare shield or adjacent panels to gain access to electrical connectors.
3. Disconnect 2 electrical connectors.
4. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. Accomplish applicable engine check. (Necessitates engine run-up.)

8. ANALYST'S COMMENTS: On most installations, cables to the indicators are too short to allow the indicator to clear the instrument panel sufficiently to disconnect the electrical connectors. As a consequence, additional removals (glare shield/adjacent panels) must be accomplished. The need for an engine run-up to checkout indicator installation is a time consuming and expensive method of assuring the quality of a maintenance action. This would be a cost effective area to effect substantial improvements and changes in traditional procedures.

NOMENCLATURE: Fuel Quantity Indicators
PHOTO ID NO.: 37

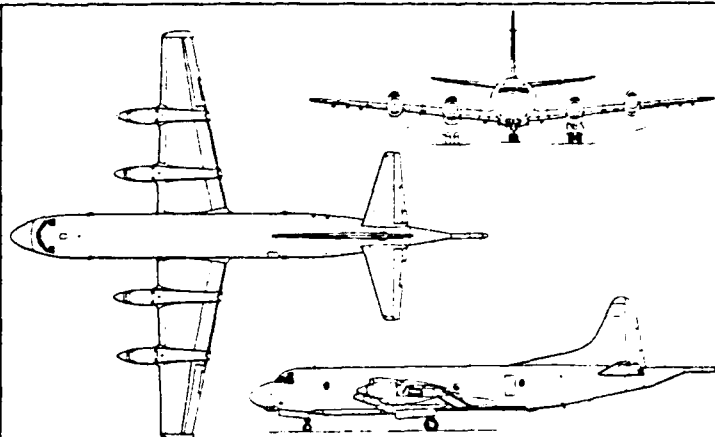
WORK UNIT CODE: 51511
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center console.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Loosen 1 Phillips head. (Frees indicator which is secured by clamp.)
2. Remove electrical connector.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: TF-20

Actions: 1. Requires calibration with TF-20.

8 ANALYST'S COMMENTS: This installation is good. Maintenance personnel cited problems with the adapter cables for the TF-20 as the biggest drawback in completing the installation action. The cables require delicate handling and constant attention to ensure servicability. (Internal breaks and coax connectors come loose.)

NOMENCLATURE: EFU 39/A Fuel Quantity Indicator
PHOTO ID NO.: 27

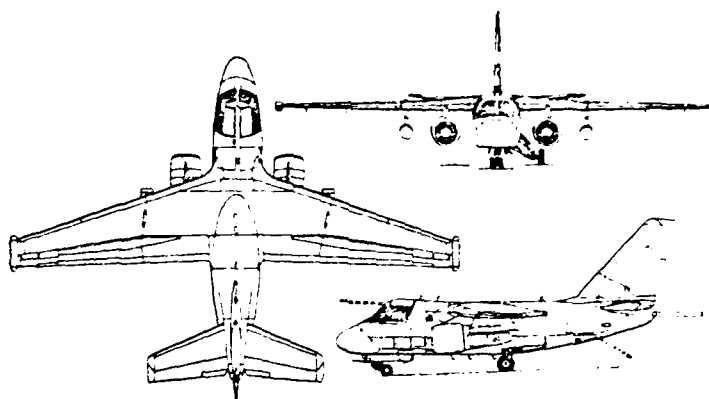
WORK UNIT CODE: 51512
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Center instrument panel.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL:
1. Release 4 DZUS fasteners from Fuel Control Panel.
 2. Disconnect 3 electrical connectors.
 3. Loosen clamp (Phillips head).
 4. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Perform fuel quantity gaging and low level warning system functional checkout.

8. ANALYST'S COMMENTS: A good installation, despite the fact that the Fuel Control Panel must be removed to gain access to the electrical connectors.

AD-A090 632

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QUALITATIVE MAINTENANCE EXPERIENCE HANDBOOK. P-3C/S-3A SUPPLEME--ETC(U)
JUN 77 K I WEBMAN, D DUERRE N00140-76-C-0025

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2 OF 2

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NOMENCLATURE: ID-1556/AJN-15 Flight Director Indicator
PHOTO ID NO.: 53

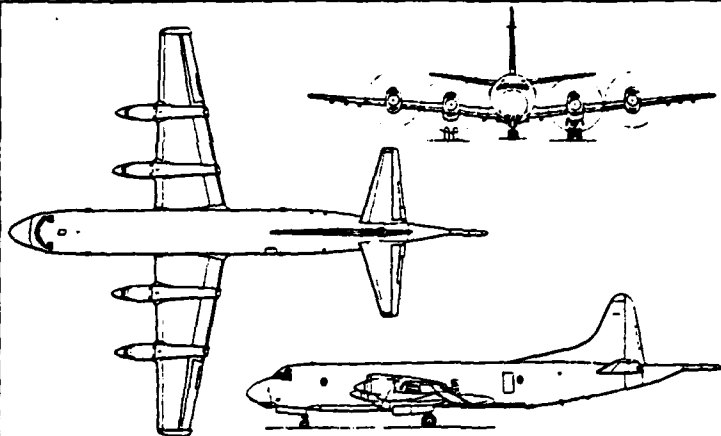
WORK UNIT CODE: 73134
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Pilot's and copilot's instrument panel.

2. SUPPORT EQUIPMENT:

- ☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Remove 4 Phillips head screws from face of unit.
2. Remove electrical connector.
3. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. Functional check in Standby and Inertial Nav.
2. Inflight check of turn rate indicator required (after replacement of the flight director indicator).

8. ANALYST'S COMMENTS: The remove and installation actions are standard for nearly all instruments in the aircraft. Cable length is sufficient to allow access for cable disconnect and the method of mounting is uncomplicated. This is a good installation.

FLIGHT REFERENCE/AFCS SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Flight Instruments	51131 .	51121 . 51122 .
Air Data Computer	56460 .	56711 .
Automatic Flight Control Components	57381 . 5738H .	57364 . 57367 .

SYSTEM: FLIGHT REFERENCE/AFCS

• GENERAL COMMENTS:

As with nearly all avionic installations on both aircraft, accessibility is not a problem. The size and arrangement of the aircraft provides ample room for location and mounting of equipments. This aspect alone makes a comparison between the Flight Reference/AFCS installations on a fighter/attack aircraft and the patrol/search aircraft almost certainly to be detrimental to the smaller aircraft. With one exception, the Angle of Attack Transmitter on the S-3A, all installations were simple and straightforward with good to excellent accessibility, ample cable length, and standard connections and mounting. In the case of the Angle of Attack Transmitter on the S-3A, the cover plate requires different length Phillips head screws. This necessitates the institution of controls by the technician to ensure return of the original screw to the proper depth receptacle. This should be avoided whenever possible, particularly on cover plates and panels. Also on the minus side is the use of loose nuts, bolts, and washers. As reported by maintenance personnel, the instances of dropped hardware consumes sufficient man hours to compensate for additional costs in design or hardware to eliminate the problem. Washers should be captive to the bolt; bolts captive to the equipment, etc. If this is not possible, then a FOD catcher should be provided in the vicinity where the loose hardware is being employed.

NOMENCLATURE: Angle of Attack Indicator
PHOTO ID NO.: 35

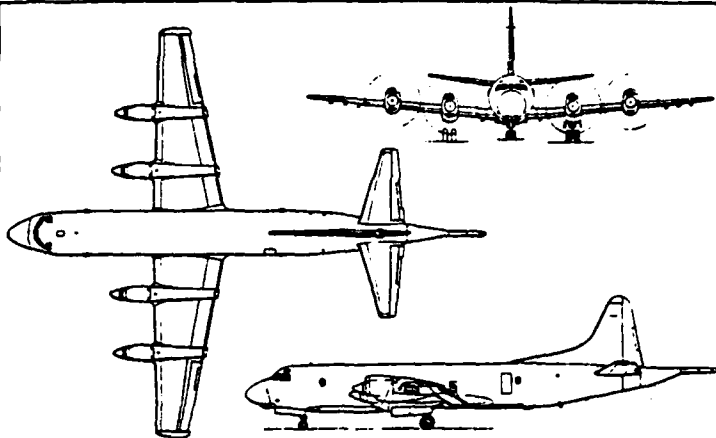
WORK UNIT CODE: 51131
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Pilot's and Copilots instrument
panels

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Remove light cowl (2 Phillips head screws).
2. Remove 3 Phillips head screws from face of instrument.
3. Disconnect 1 electrical connector.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required:
Actions: 1.- Perform operational check, adjust dial if required.

8. ANALYST'S COMMENTS: A good installation. Accessibility is excellent due to roominess of cockpit. Organizational level personnel report that replacement of the AOA indicator requires an Inflight Evaluation and alignment in flight. Alignment is accomplished on face of unit.

NOMENCLATURE: Angle of Attack Indicator
PHOTO ID NO.: 29

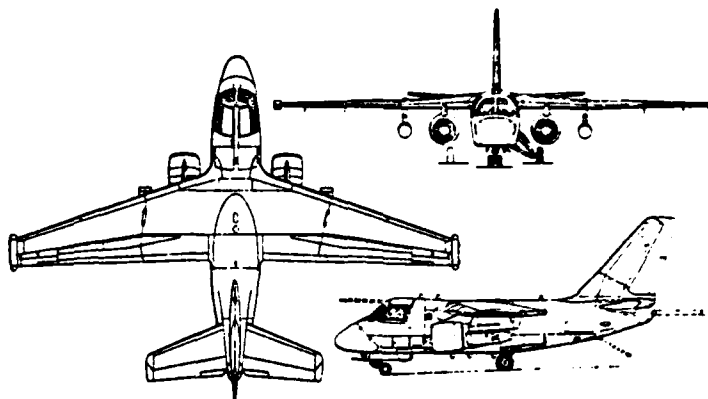
WORK UNIT CODE: 51121
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Pilots and Copilots instrument
panel.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove 3 High-Torque screws.
 2. Ease unit from instrument panel and disconnect electrical connector.
 3. Remove indicator.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1+ Accomplish angle of attack indicator functional check.

8. ANALYST'S COMMENTS: This is a straightforward installation with no problems.

NOMENCLATURE: Angle of Attack Transmitter
PHOTO ID NO.: 23

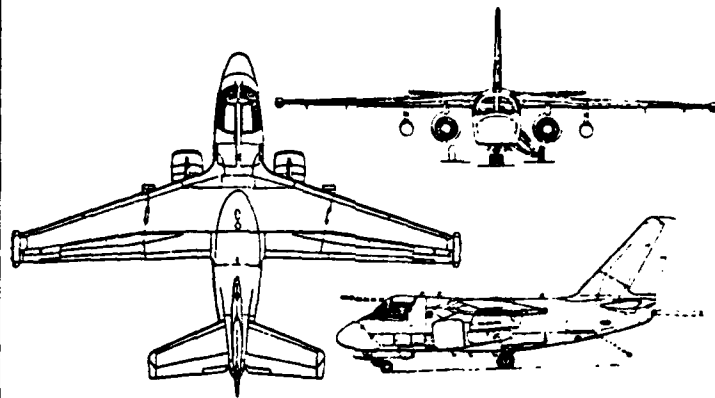
WORK UNIT CODE: 51122
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
FWD RH Fuselage

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cover plate with 8 Phillips head screws (different lengths). Captive nuts used to mount plate.

5. REMOVAL: 1. Note installation index setting.
2. Remove 4 nuts and washers.
3. Rotate and remove AOA transmitter from mounting plate.
4. Disconnect electrical connector.

6. INSTALLATION: ☒ Reverse Of Removal
Insure AOA transmitter is aligned to installation index setting noted during removal.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: 3 men required, one on probe, one in cockpit and one in wheel well.
Test Equipment Required:
Actions: Accomplish angle of attack indicator system functional check.

8. ANALYST'S COMMENTS: The varied length of the cover plate mounting screws necessitates tagging or the establishment of some other means of identifying the screws to the positions they formerly occupied. From any point of view, this is unsatisfactory. In addition, the mounting nuts, washers and bolts, and the captive nuts utilized to secure the cover plate, are a constant FOD threat.

NOMENCLATURE: CPK-28/A24G9 Computer
PHOTO ID NO.: 38

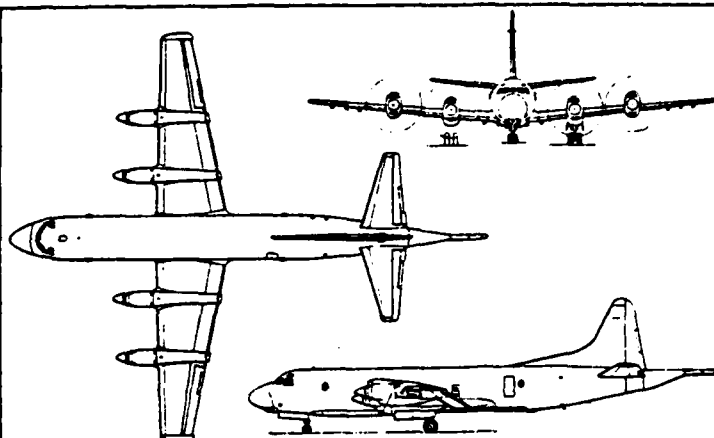
WORK UNIT CODE: 56460
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronic rack C-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door to rack.

5. REMOVAL: 1. Loosen 2 wingnuts. (Lockwired.)
2. Remove 2 pneumatic lines.
3. Disconnect electrical connector.
4. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: Air Data Computer Test Set, TTU-205.

Actions: 1. Accomplish leak checks.
2. Perform functional check.
3. Requires inflight evaluation.

8. ANALYST'S COMMENTS: Space availability and method of mounting make this a good installation.

NOMENCLATURE: CP-1077()/AYN-5 Airspeed Altitude Computer
PHOTO ID NO.: 4

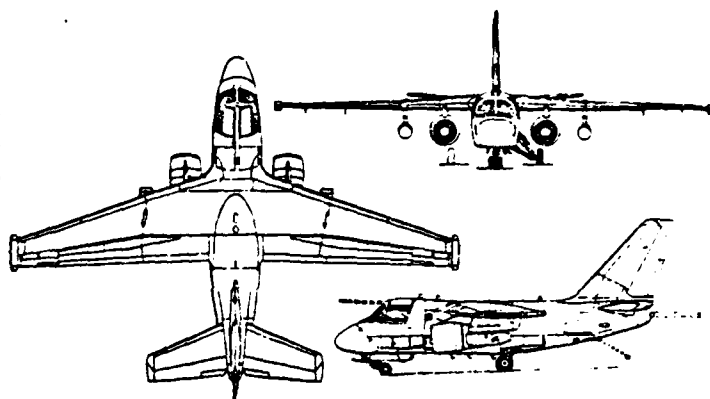
WORK UNIT CODE: 56711
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
LH bay, middle row, RH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment

5. REMOVAL: 1. Loosen equipment panel retainer lock lugs.
2. Disengage rack & panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: TTU-205

Actions: 1- Integrated systems check required.

2. Altimeters at both stations must be reset to agree within tolerances with
input altitude.

3. In-flight Evaluation (IFE) is required.

8. ANALYST'S COMMENTS: This is a good installation, but the requirement for IFE after
replacement detracts from otherwise easy task.

NOMENCLATURE: CN-1316/ASW-31 Gyroscope
PHOTO ID NO.: 45

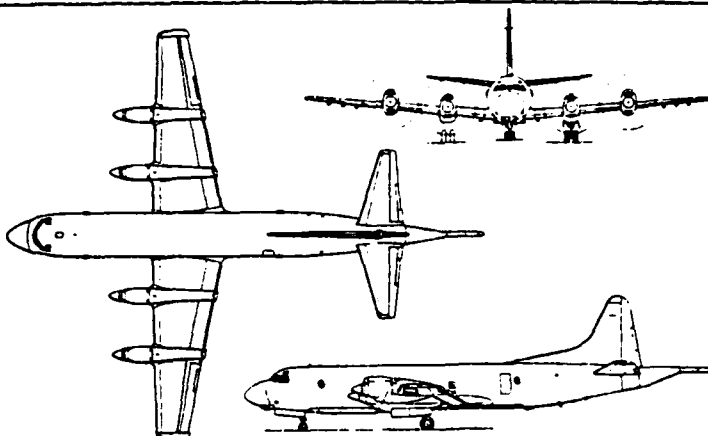
WORK UNIT CODE: 57381
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics rack D-3.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door of rack.

5. REMOVAL: 1. Remove 4 bolts.
2. Disconnect electrical connector.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Perform AFCS operational check.

8. ANALYST'S COMMENTS: This is a standard installation with good access.

NOMENCLATURE: CN1370/ASW33 Rate Gyroscope
PHOTO ID NO.: 24

WORK UNIT CODE: 57364
AIRCRAFT: S-3A

1. LOCATION: (Indicate)

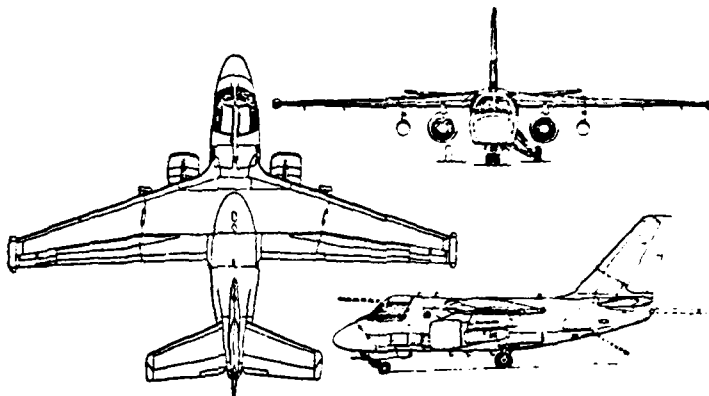
RH Bomb Bay, 2 locations, side by side.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric
☐ Hydraulic

3. PREPARATION:

☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open bomb bay doors.

5. REMOVAL:
1. Disconnect electrical connector.
 2. Remove 4 Phillips head screws.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☒ Hydraulic

Access Required: Cockpit

Test Equipment Required: TTU-205, BA59-103

Actions: 1. Perform AFCS functional check.

8. ANALYST'S COMMENTS: This is a simple, straightforward installation.

NOMENCLATURE: AM-6259/ASW-31 Pitch Control Amplifier
PHOTO ID NO.: 58

WORK UNIT CODE: 5738H
AIRCRAFT: P-3C

1. LOCATION: (Indicate)

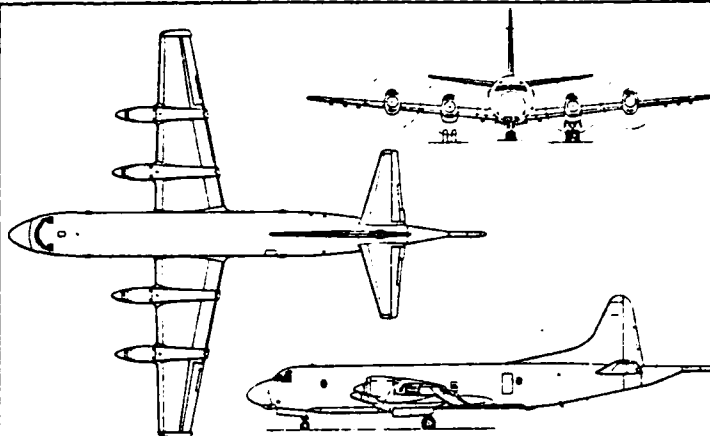
Electronic Rack C-1

2. SUPPORT EQUIPMENT:

- ☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION:

- ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door to rack.

5. REMOVAL:
1. Remove 1 electrical connector.
 2. Remove 4 bolts (captive).
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

- Actions: 1. Accomplish AFCS operational check.
 2. Requires In Flight Evaluation (IFE).

8. ANALYST'S COMMENTS: This is a good installation but maintenance personnel were critical of the lack of balance potentiometers.

NOMENCLATURE: CP-1074/ASW-33 Flight Data Computer
PHOTO ID NO.: 7

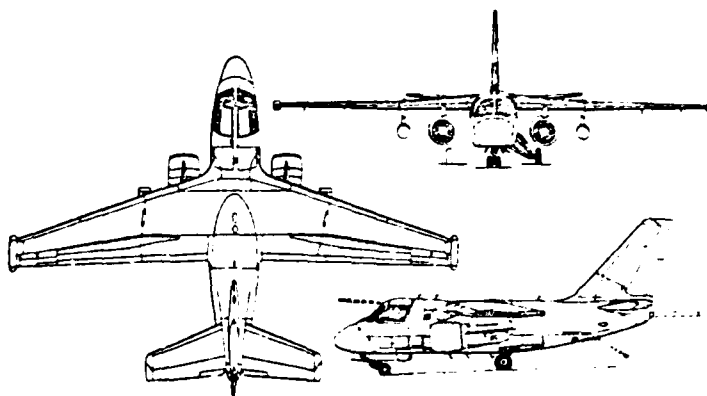
WORK UNIT CODE: 57367
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
RH bay, middle row, RH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL: 1. Loosen equipment panel retainer lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None
Access Required: Pilot's station
Test Equipment Required:

Power Requirements: ☒ Electric ☐ Hydraulic

Actions: 1. Accomplish automatic test using BITE, ground and manual test.

8. ANALYST'S COMMENTS: Unit weighs approximately 47 pounds. Front mounted handles ease removal--a good installation.

COMMUNICATION SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
UHF Radio:		
Receiver Transmitters	632K1.	63271 .
Control Boxes	632K3.	63274 .
IFF Receiver Transmitters	65321 .	65321 .

SYSTEM: COMMUNICATION

• *GENERAL COMMENTS:*

Six installations were studied under this system heading, UHF Receiver Transmitters and Control Boxes and IFF Receiver Transmitters, on both aircraft. Generally, the components were easy to remove and install although one required use of a workstand. In two instances, removal was inhibited by insufficient slack in the cables, degrading otherwise good installations. Two units on the S-3A were located in external bays, access to which was gained through doors secured with quick release fasteners. The fasteners required no tools and were outstanding in their ease of operation. Finger operated latches similar to or the same as those employed on the S-3A would be a welcomed improvement if used on all maintenance access doors.

• *UHF RECEIVER TRANSMITTERS/CONTROL BOXES*

The UHF, ARC-143, installations on the P-3C aircraft suffered from lack of adequate cable length. In the case of the control box, it appeared that the failing was caused by frequent repairs to the cable connector. In the installation looked at, an adjacent panel had been removed to gain access to the connector. The RT unit installation, however, appeared to be the original cable harness with no repairs evident. Fortunately, the ample space available in the proximity of the RT unit provided "reach around" room, thus negating the need to remove adjacent equipment to gain access to the connectors. All harness installations should routinely be designed and fabricated to provide sufficient cable slack to ease removal and accommodate a specified number of repairs without degrading the installation.

The RT unit (ARC-156) on the S-3A was the only unit in this group requiring a workstand to affect removal and installation. The unit is located in the AFT LH external avionics bay and the location does pose accessibility problems during cruises.

NOMENCLATURE: RT-932()/ARC-143 Receiver Transmitter
PHOTO ID NO.: 42

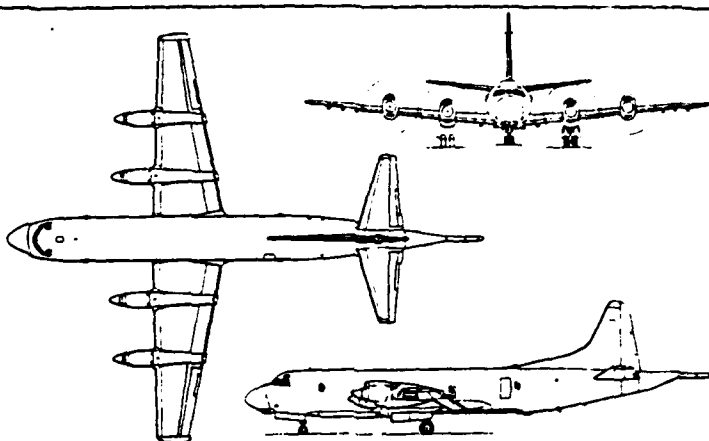
WORK UNIT CODE: 632K1
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics Rack F-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door to rack.

5. REMOVAL: 1. Disconnect 1 coax cable (face of unit).
2. Disconnect 3 electrical connectors from rear.
3. Loosen 2 knurled knobs.
4. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: NAV COMM station

Test Equipment Required:

Actions: Perform operational check.

8. ANALYST'S COMMENTS: Access is fair to good depending on length of cables connected to rear of the RT unit. The face mounted filter screens are easily mangled and honeycomb crushed during installation. The installed unit reflected evidence of minor repair. Other units examined were substantially worse.

NOMENCLATURE: RT-1017/ARC-156 Receiver Transmitter
PHOTO ID NO.: 15, 16

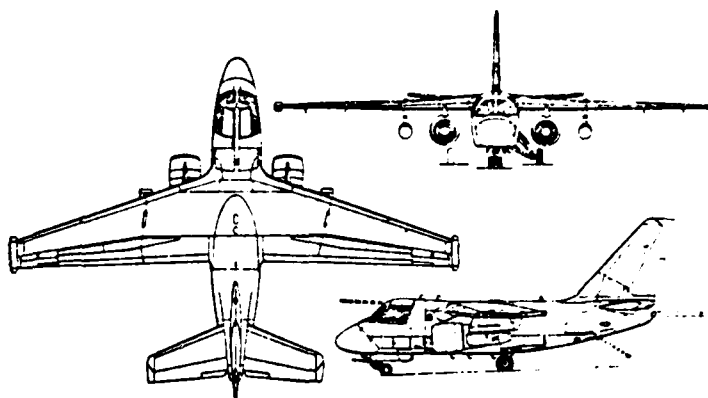
WORK UNIT CODE: 63271
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Two locations. RH lower corner of
Aft LH external avionics bay.

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open aft avionics bay compartment (4 quick release fasteners, 2 support arms).

5. REMOVAL: 1. Loosen equipment panel lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1- Perform operational check.

8. ANALYST'S COMMENTS: Removal, installation and checkout are uncomplicated. Quick release latches on the access panel are an excellent aid to expedite maintenance.

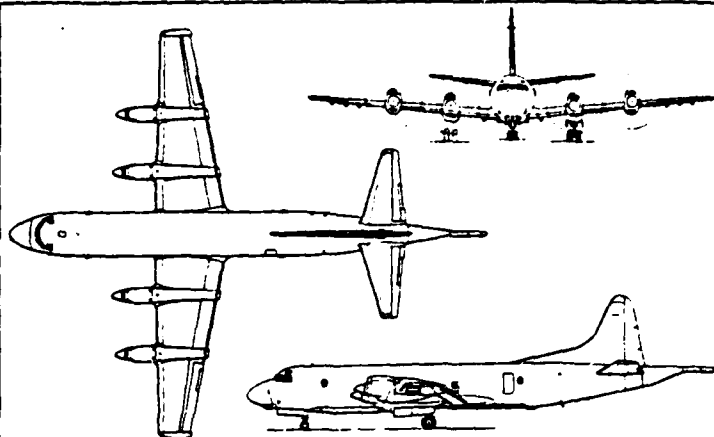
NOMENCLATURE: C-7791()/ARC-143 Radio Set Control
PHOTO ID NO.: 47

WORK UNIT CODE: 632K3
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Center console and Nav-Comm station.

2. SUPPORT EQUIPMENT:
☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit or Nav-Comm station.

5. REMOVAL: 1. Release 4 DZUS fasteners.
2. Disconnect electrical connector.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Cockpit/Nav-Comm station.
Test Equipment Required:
Actions: Operational check from appropriate station.

8. ANALYST'S COMMENTS: This is a good installation, marred by the fact that many cables are too short for easy removal of connector due either to routing or previous repair action.

NOMENCLATURE: C-8881/ARC-156 Freq Selector Control
PHOTO ID NO.: 25

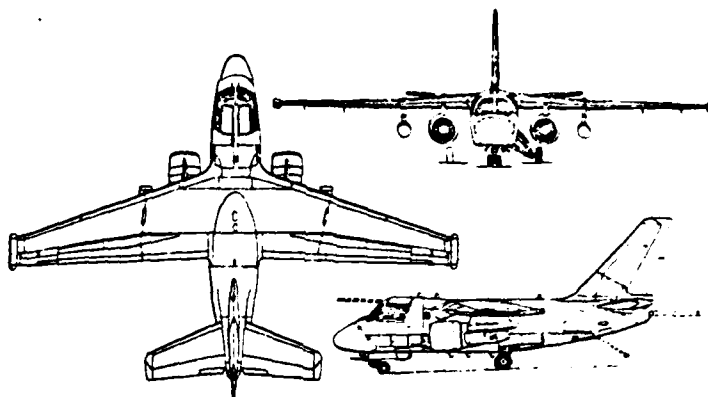
WORK UNIT CODE: 63274
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Cockpit, LH console

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Release 4 DZUS fasteners.
 2. Raise control and disconnect electrical connector.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Accomplish operational check.

8. ANALYST'S COMMENTS: This is an uncomplicated installation with excellent access. The cockpit side cowlings covers portions of the DZUS fasteners on the light control panel.

NOMENCLATURE: RT-868()/APX-76 Receiver Transmitter
PHOTO ID NO.: 43

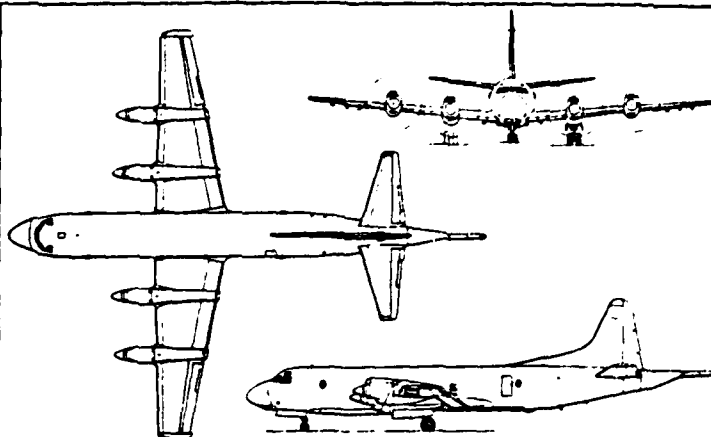
WORK UNIT CODE: 65321
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics rack F-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door of rack.

5. REMOVAL: 1. Remove 1 coax cable.
 2. Disconnect 2 electrical connectors.
 3. Loosen 2 knurled knobs.
 4. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Sensor station 3

Test Equipment Required:

Actions: Perform operational check.

8. ANALYST'S COMMENTS: This is a straightforward installation with easy removal and replacement.

NOMENCLATURE: RT-868()/APX-76 Receiver Transmitter
PHOTO ID NO.: 22

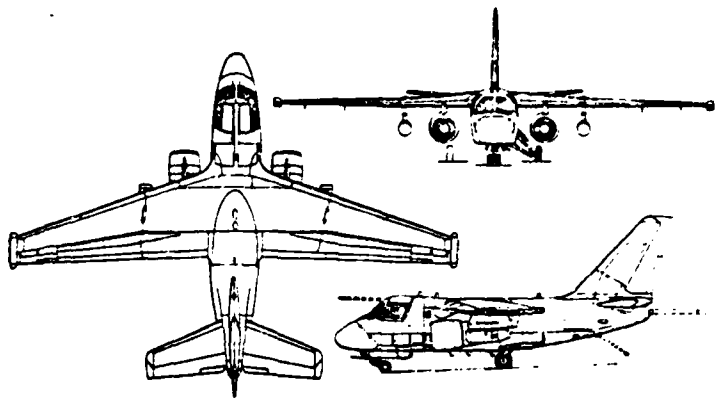
WORK UNIT CODE: 65321
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Upper rack, LH FWD external
avionics bay

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: 1. Open access door (quick release fasteners).
 2. Install door support arms (pip pins).

5. REMOVAL: 1. Disconnect 2 electrical connectors.
 2. Loosen 2 knurled knob attach lugs.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1. Accomplish functional checks consisting of BITE check and power on tests.

8. ANALYST'S COMMENTS: Easy access, fast removal and replacement are strong points of this operation. However, fault flags are reportedly not dependable and do not reset.

NAVIGATION SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Tacan	N/A	713C1
Radar Altimeter	7236C	722H2 722H1
Radar	726A1 726A2	727H3
Doppler	723A2 723A3	N/A
Controls	N/A	729F2

SYSTEM: NAVIGATION

• *GENERAL COMMENTS:*

All installations in this area were generally good. When applicable, all made use of quick release type fasteners and connections. The panel mounted indicators used a standard type mounting consisting of Phillips head screws, a mounting design common to the majority of Naval aircraft.

Three items, the FWD and AFT APS-115 antenna (P-3) and the APN-201 Transmitter (S-3), required the use of workstands to affect removal. Even then, access was rapid and easy due to the use of quick release latches on the radomes and equipment bay doors. Once access was gained, removal and installation could be accomplished with what were considered to be minor inconveniences.

• *RT-1023/APN-201 RADAR RECEIVER TRANSMITTER (S-3A):*

This is a good installation, using quick release fasteners and rack and panel connectors, but it is marred by the fact that the unit cannot clear the access door frame without being raised slightly. This is a failing that could have been avoided if the equipment rack had been elevated slightly.

• *AS-2146/APS-115 ANTENNA (P-3C):*

The forward and aft antenna installations are located approximately 10 and 12 feet, respectively, above ground level necessitating use of a workstand to gain access. The radomes are secured with a series of quick release latches, affording rapid access to the antennas. The biggest problem encountered is caused by the bulkiness of the antenna itself. Considering this, and the locations, installation designers did a good job of matching the unit to the structure. Slight improvements could have been made at a sacrifice of cost and weight by adding provisions for removal and installation and eliminating some of the support equipment now required. For example, the hoist, hoist mount, and spreader bar could have been built into the antenna/mounting so that a cable and drive assembly, incorporated into the fuselage and operated by a pneumatic or electric drill, could be used to accomplish the removal/installation. This would eliminate the need for a hoist mount, block and tackle (hoist), spreader bar and the associated hardware attachments.

NOMENCLATURE: RT-1022/ARN-84 Receiver Transmitter
PHOTO ID NO.: 6

WORK UNIT CODE: 713C1
AIRCRAFT: S-3A

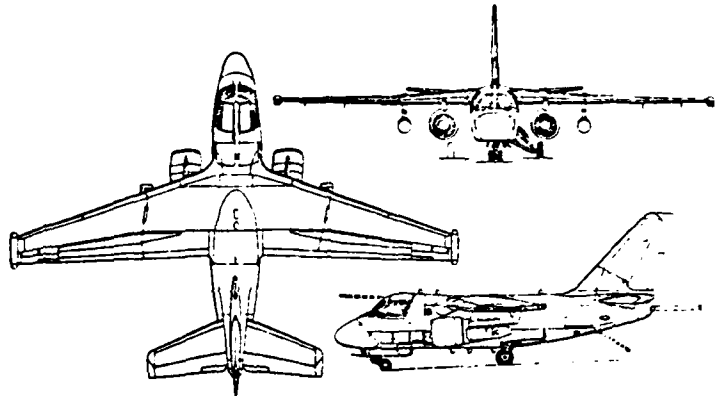
1. LOCATION: (Indicate)

RH bay, top row, RH internal
avionics bay.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL:
1. Disconnect 3 coax connectors.
 2. Loosen 2 knurled knob retainers.
 3. Disengage rack and panel connector.
 4. Remove unit.

NOTE: Signal Data Converter (WUC 713C3) is removed with Receiver Transmitter.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required: URM-101

- Actions:
1. Run TACAN Self-test.
 2. Accomplish functional check.

8. ANALYST'S COMMENTS: With easy access and a simple check-out, this is a good installation.

NOMENCLATURE: ID-1304/APN-141(V) Height Indicator
PHOTO ID NO.: 44

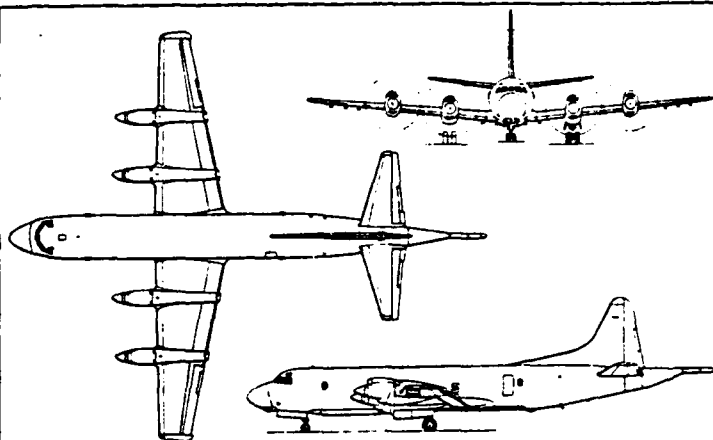
WORK UNIT CODE: 7236C
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Pilots and copilots instrument panel.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit

5. REMOVAL: 1. Remove 3 Phillips head screws from face of indicator.
2. Disconnect electrical connector.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required:
Test Equipment Required: Radar Altimeter Warning System Test Set.
Actions: 1. Accomplish functional check.

8. ANALYST'S COMMENTS: A typical P-3C installation, it has good access, good visibility, good cable length.

NOMENCLATURE: ID-1770/APN 201 Height Indicator
PHOTO ID NO.: 31

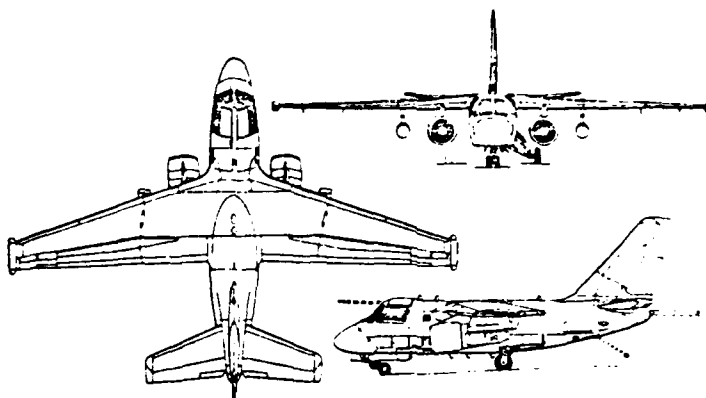
WORK UNIT CODE: 722H2
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Cockpit instrument panel

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP:

5. REMOVAL: 1. Remove 3 Phillips head screws.
2. Slide unit forward and disconnect electrical connector.
3. Remove instrument.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Cockpit
Test Equipment Required:
Actions: 1. Perform operational check.

8. ANALYST'S COMMENTS: This is a good installation. Electrical cable length is sufficient to allow connector to be easily disconnected.

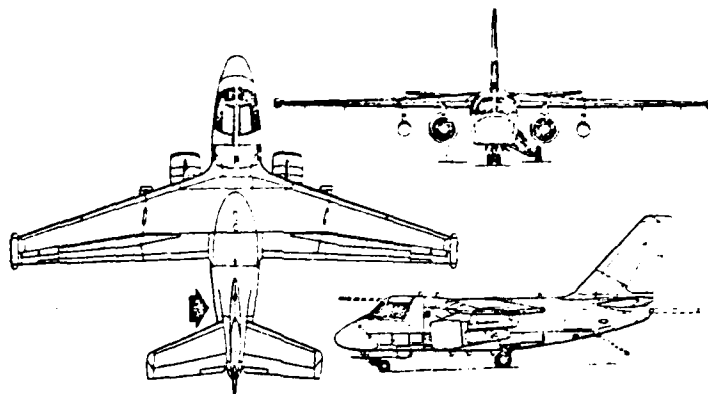
NOMENCLATURE: RT-1023/APN-201 Radar Receiver Transmitter
PHOTO ID NO.: 14

WORK UNIT CODE: 722H1
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Lower LH corner of aft LH external
avionics bay.

2. SUPPORT EQUIPMENT:
☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open aft avionics bay compartment (4 quick release fasteners, 2 support arms).

5. REMOVAL: 1. Loosen equipment panel lock lugs.
2. Disengage rack and panel connector.
3. Remove unit by pulling forward slightly and raising front end to clear lip of panel door frame.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Cockpit
Test Equipment Required:
Actions: 1. Self test accomplished using on board computer. May also be accomplished off line.

8. ANALYST'S COMMENTS: The requirement to lift the unit over the door frame in order to affect removal could have been solved by installing a false bottom in the equipment rack. This would lessen sheet metal and equipment damage.

NOMENCLATURE: AS-2146/APS-115 Antenna
PHOTO ID NO.: 55

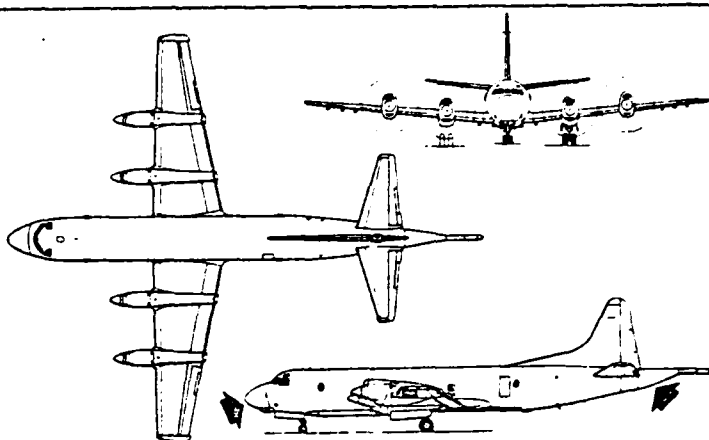
WORK UNIT CODE: 726A1
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
FWD and AFT

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling FWD/AFT
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Antenna Support and
☐ Hydraulic Chassis Dolly.

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open FWD/AFT radome as applicable. FWD radome has 6 clevis latches with DZUS fastener holddowns and is hinged at top. AFT radome has 4 clevis latches and radome slides toward rear on rails.

5. REMOVAL: 1. Remove absorbtion blanket. (Nine snaps.)
2. Remove tubular frames. (6 screws and nuts.)
3. Attach hoist.
4. Remove center screws from upper assembly of antenna.
5. Install spreader bar to upper assembly (clevis fittings).
(see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Sensor station 3

Test Equipment Required:

Actions: 1. Perform waveguide pressurization check.
2. Accomplish radar operational check.

8. ANALYST'S COMMENTS: Considering the size and location of these units, the installation is a good one. Design incorporated accessibility and ease of mounting when mating the antenna to the structure.

NOMENCLATURE: AS-2146/APS-115 Antenna

WUC: 726A1
AIRCRAFT: P-3C

5. REMOVAL: (continued)

6. Disconnect waveguide from waveguide switch, (4 screws).
7. Remove azimuth and tilt amplifier cable clamps.
8. Disconnect 2 electrical connectors, (lockwired).
9. Disconnect APX-76 coax and coax cable clamp.
10. Attach block and tackle. (Part of hoist assembly.)
11. Tie guide rope to antenna jackscrew.
12. Remove 4 mounting nuts, bolts and washers.
13. Lower antenna onto dolly and secure with pip pins.

NOTE: Procedure for removal of FWD and AFT antennas are essentially identical except for use of B-4 stand and a 905245-1 hoist on the FWD installation and a B-5 stand and a 917739-1 hoist on the AFT installation.

NOMENCLATURE: T-1203/APS-116 Transmitter
PHOTO ID NO.: 21

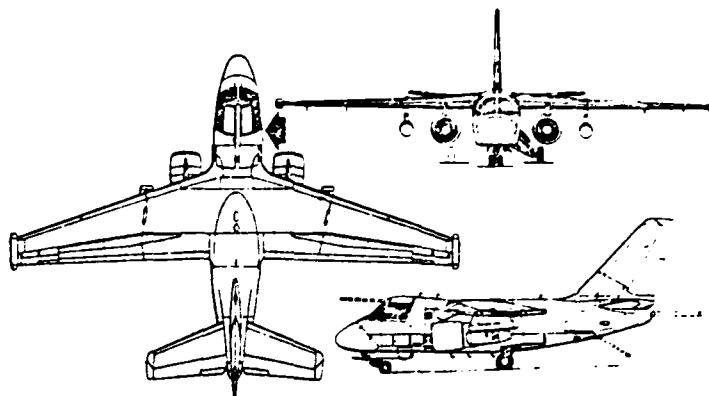
WORK UNIT CODE: 727H3
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
RH FWD external avionics bay.

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric Handling Dolly and
☐ Hydraulic Adapter.

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open avionics bay door (2 quick release latches).

5. REMOVAL: 1. Remove 2 electrical connectors.
2. Disconnect waveguide pressurization hose coupling.
3. Remove waveguide bracket.
4. Remove waveguide from Transmitter and Synchronizer.
5. Remove waveguide from transmitter (3J5).
6. Remove 2 mounting bolts.

(see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: SENSO/TACCO/COPILOT Station

Test Equipment Required:

Actions: 1. Accomplish waveguide purging procedure.
2. Perform system leak check.
3. Perform radar system functional check.

8. ANALYST'S COMMENTS: Considering that this unit weighs 173 pounds, this installation is a good one. Organizational level personnel reported that the carrying handles, located on the sides of the unit, are inaccessible during most of the removal and installation cycle and that a front mounted handle would aid accomplishment of those actions. Another minor irritant cited was the fact that the avionics bay access door latch interferes with the removal and installation action.

NOMENCLATURE: T-1203/AP3-116 Transmitter

WUC: 727H3
AIRCRAFT: S-3A

5. REMOVAL: (Continued)

7. Loosen 2 knurled knobs.
8. Disconnect access door support cables.
9. Install adapter (BA62-101) on handling dolly and position dolly.
10. (2 men) Slide Transmitter from rack onto handling dolly and secure.

NOMENCLATURE: RT-889/APS-115 Receiver Transmitter
PHOTO ID NO.: 41

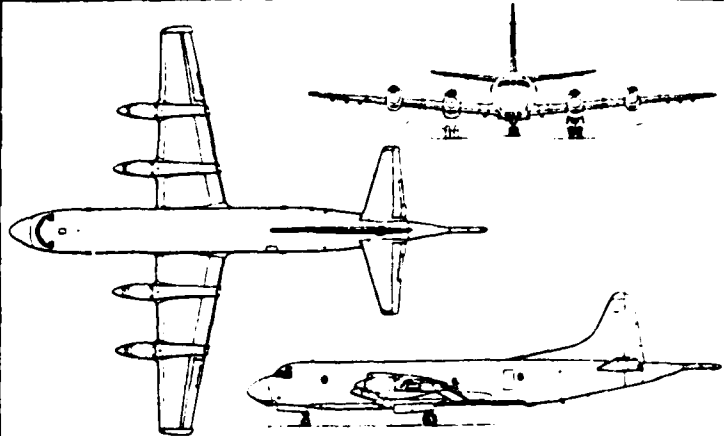
WORK UNIT CODE: 726A2
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
FWD Electronics Rack A-1
AFT Electronics Rack J-1/2

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Remove doors to rack A-1 or J-1/2 as applicable. For FWD installation, remove enclosure top also.

5. REMOVAL: 1. Disconnect 2 electrical connectors.
2. Disconnect 3 coax cables.
3. Relieve pressure.
4. Disconnect waveguide from Receiver-Transmitter (4 screws).
5. Remove 3 FWD and 3 AFT mounting bolts and washers.
6. Remove uniĒ. (Dessicator assembly is removed with Receiver Transmitter.)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Sensor station 3
Test Equipment Required:
Actions: 1. Perform waveguide pressurization check.
2. Accomplish radar operational check.

8. ANALYST'S COMMENTS: Except for the size and weight of this unit, the removal and installation pose no significant problems. Access is good and E-rack door removal merely consists of opening door and lifting the door off its hinges.

NOMENCLATURE: RT-890/APN-187 Antenna Receiver Transmitter
PHOTO ID NO.: 54

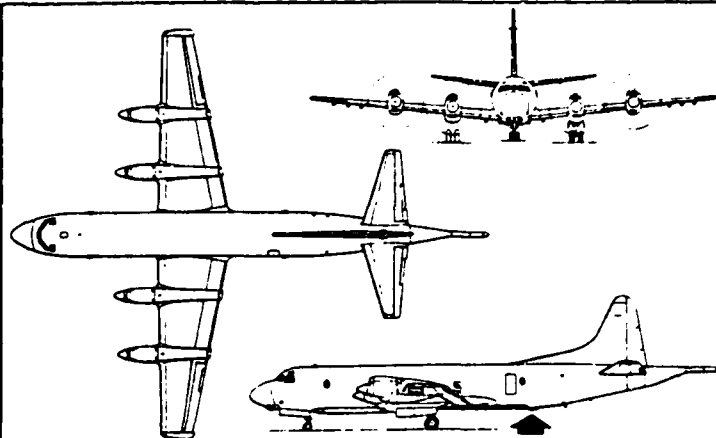
WORK UNIT CODE: 723A2
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
AFT bottom fuselage of aircraft.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open radome, 15 DZUS fasteners, hinged.

5. REMOVAL: 1. Disconnect 1 electrical connector and ground strap.
2. Remove 4 mounting bolts from shock mounts.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: NAV COMM station
Test Equipment Required:
Actions: 1. Accomplish Doppler operational check.

8. ANALYST'S COMMENTS: This is a good clean installation because there is good access to the connector and excellent access to the mounting bolts.

NOMENCLATURE: C-7514/APN-187 Control Indicator
PHOTO ID NO.: 51

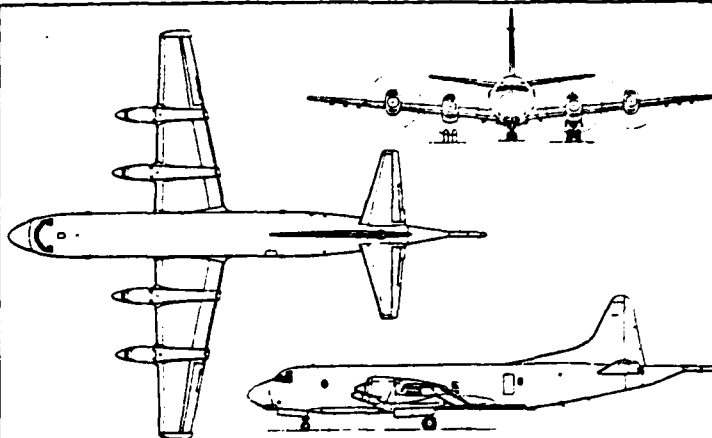
WORK UNIT CODE: 723A3
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
NAV COMM station control panel.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: NAV COMM station.

5. REMOVAL: 1. Release 4 DZUS fasteners.
2. Disconnect 1 electrical connector.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: NAV COMM station and cockpit.
Test Equipment Required:
Actions: 1. Accomplish operational check.

8. ANALYST'S COMMENTS: This is an excellent installation, with good access, a minimum of connectors and sufficient cable length.

NOMENCLATURE: C-8788/AP Radar Set Control
PHOTO ID NO.: 3

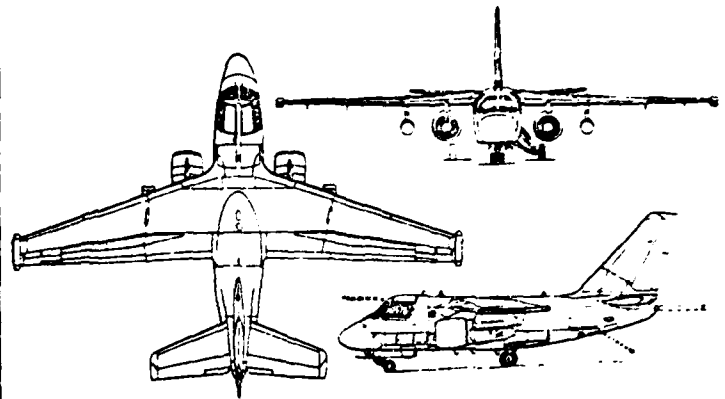
WORK UNIT CODE: 729F2
AIRCRAFT: S3A

1. LOCATION: (Indicate)
Center bay, bottom row, RH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment

5. REMOVAL: 1. Loosen equipment panel retainer lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Co-pilot or Tacco station.
Test Equipment Required:
Actions: 1. Load computer, run BIT check.
2. Accomplish radar operational or diagnostic program.

8. ANALYST'S COMMENTS: This is a relatively simple task complicated by the need to move the aircraft to a remote location prior to radiating. Use of an RF absorbtion blanket could provide some relief to the requirement to move the aircraft.

BOMB NAVIGATION/WEAPONS CONTROL SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Indicators and Controls	732A1	73B43 .
Sweep Generators/Processors/Data Converters	73X1M .	73B31 .
		734M2 .
Inertial Measurement System Components	734F6 .	734H2 .
	734F7 .	734H3 .
		734H1 .

SYSTEM: BOMB NAVIGATION/WEAPONS CONTROL

• GENERAL COMMENTS:

Of the 10 installations reviewed under this category, eight could be considered good with regard to accessibility and method of connection. Two were regarded as poor: one because of problems associated with removal of the air duct; and the second due to the need to remove adjacent equipment to gain access to the mounting bolts. Two of the installations considered as good could be improved by using captive bolts (in one case) and the other by improving the method of attachment of the floating anchor nuts, and by a general beef up of the handle and front cover to permit the technicians to "carry" the unit using the front handle.

• IP-1054/ASA-82 TAC ACOUSTIC INDICATOR, S-3A:

Access is good but release of the air duct (two DZUS fasteners) is difficult due to location of the outboard fastener. Technicians now remove the clamp securing the air hose to the duct and, following removal of the unit, remove the duct and re-install it on the air hose. This creates unnecessary steps in the procedure which could have been avoided if the air duct and air duct receptacle had been designed to mount vertically, rather than horizontally, allowing access to the outboard fastener.

• CV-2461()/A SIGNAL DATA CONVERTER, P-3C:

In this installation, the ASW-31 Gyroscopic Assemblies mounting bracket must be removed and displaced to gain access to the Signal Data Converter mounting bolts. In an aircraft this size, and with the relatively vast amount of space available within the various Electronic Racks, this is unsatisfactory. Fortunately, it is an exception to the generally good accessibility to avionic equipment available throughout the aircraft.

• PP-6188/ASN-92(V) POWER SUPPLY, S-3A:

Use of knurled knob tie down or, as a minimum, a captive bolt requirement should have been included in the specification covering the design of the unit. The result of this omission is an almost archaic installation in a modern jet aircraft, a minor inconvenience in this case due to the excellent accessibility and its location in an area that can easily be searched in case of a dropped bolt. The same installation on the F-14, however, poses problems avoided here because of adequate internal space availability.

• CN-1263/ASN-92(V) INERTIAL MEASUREMENT UNIT, S-3A:

The method of attaching the captive mounting nuts allows too much free play, creating difficulty for the technician attempting to center the mounting bolts. The cover securing the captive nuts should allow some play, but also should be self-centering. Another minus is the handle located on the front of the unit. It is secured with two Phillips head screws. Organizational level personnel complained the unit had to be carried from the sides while the handle serves no other purpose other than to seat the unit in its rack and aid removal.

NOMENCLATURE: IP-886()/ASA-66 Tactical Data Display
PHOTO ID NO.: 52

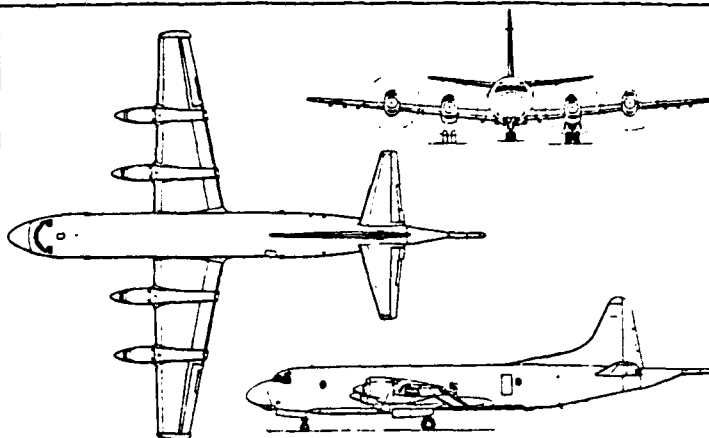
WORK UNIT CODE: 732A1
AIRCRAFT: F-4C

1. LOCATION: (Indicate)
LH center instrument panel

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Cockpit, pilot's station.

5. REMOVAL: 1. Release 6 DZUS fasteners.
2. Disconnect 4 coax and 2 electrical connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Operational check on line.

8. ANALYST'S COMMENTS: This is an excellent installation for a rather large unit. Although the cables to the unit examined were of sufficient length to allow access for removal, maintenance personnel report that this is the exception.

NGMENCLATURE: IP-1054/ASA-82 TAC Acoustic Indicator
PHOTO ID NO.: 12, 13

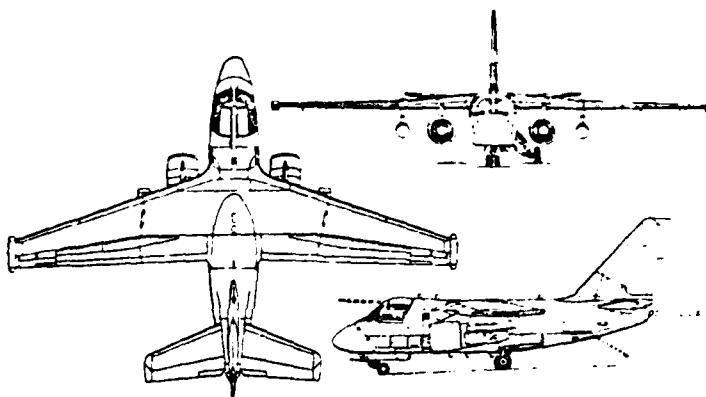
WORK UNIT CODE: 73B43
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Two locations. SENSO and TACCO stations.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: SENSO/TACCO Compartment.

5. REMOVAL: TACCO Station:

1. Remove aisle curtain and lower access panel.
2. Loosen 8 bolts from face of unit (captive).
3. Disconnect 4 twist lock connectors from rear.
5. Release air ducting (2 DZUS fasteners).
6. Remove indicator.

(see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: TACCO/SENSO station

Test Equipment Required:

Actions: 1. Accomplish tactical display subsystem functional check.

8. ANALYST'S COMMENTS: This is a straightforward installation of a relatively large unit. Organizational level reports that release of air duct is a "bearcat" due to the location of the outboard DZUS fastener. In most instances, it is easier to loosen the duct clamp and remove the right angle duct with the unit. This problem could have been avoided if duct outlet and inlet had been designed to attach in a vertical position rather than the existing horizontal position, allowing more access to DZUS fasteners.

NOMENCLATURE: IP-1054/ASA-82 TAC Acoustic Indicator

WUC: 73B43
AIRCRAFT: S-3A

5. REMOVAL: (Continued)

SENSO Station:

1. Remove air intake panel from bottom of SENSO console to gain access to tray striker plate.
2. Remove striker plate.
3. Remove aisle access panel.
4. Loosen 8 bolts from face of unit (captive).
5. Disconnect 5 twist lock connectors from rear.
6. Unfasten air ducting (2 EZUS fasteners).
7. Remove indicator.

NOMENCLATURE: CV-2461()/A Signal Data Converter
PHOTO ID NO.: 45

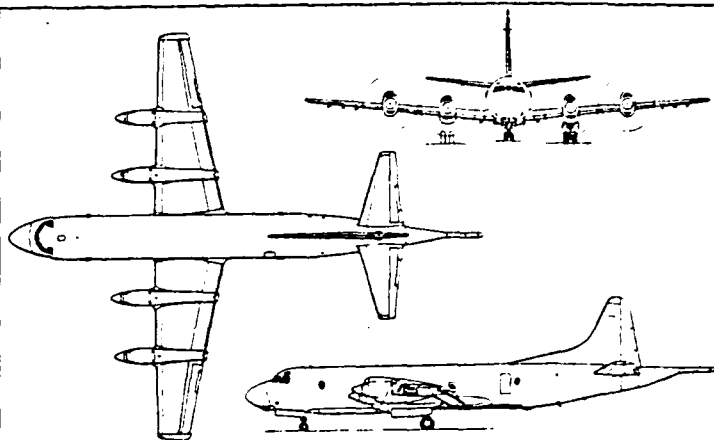
WORK UNIT CODE: 73X1M
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics rack D-3

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Remove door of rack and enclosure side cover. Remove CN-1316()/ASW-31 Gyroscope Assemblies mounting bracket with gyros attached (6 captive screws).

(See continuation sheet)

5. REMOVAL: 1. Move CN-1316()/ASW-31 Gyroscope Assemblies mounting bracket to gain access to Signal Data Converter mounting bolts on left side of unit.
2. Loosen 8 captive mounting bolts (unit is hard mounted to floor).
3. Disconnect 6 electrical connectors.
4. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: TACCO, Sensor 3 and NAV COMM stations.
Test Equipment Required:
Actions: 1. Accomplish operational check.

8. ANALYST'S COMMENTS: Considering the space availability aboard, this is a poor installation. Any time other equipment/systems must be disturbed to affect a removal or replacement action, the impact on maintenance is adverse to that desired.

NOMENCLATURE: CV-2461()/A Signal Data Converter

WUC: 73X1M
AIRCRAFT: P-3C

4. ACCESS/CLOSE UP: (continued)

NOTE: Cables to gyroscope assemblies have enough slack to allow movement of the assembly without disconnecting the cables. If cables are disconnected, then an operational check of the AFCS system must be accomplished after re-installation.

NOMENCLATURE: CV-2882/AYS Signal Data Converter Units
PHOTO ID NO.: 9

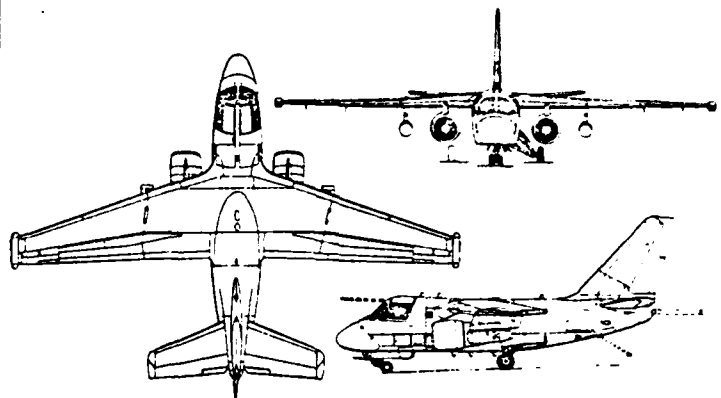
WORK UNIT CODE: 73B31
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
Two locations. Center bay, middle and bottom rows, LH internal avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL: 1. Loosen equipment panel lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: TACCO/SENSO Station

Test Equipment Required:

Actions: Perform acoustic data processor functional check.

8. ANALYST'S COMMENTS: Checkout is long (1.5 to 2 hours), tedious and complicated, mar-
ring an otherwise excellent installation.

NOMENCLATURE: CV-2858/ASN-107 A to D Converter
PHOTO ID NO.: 5

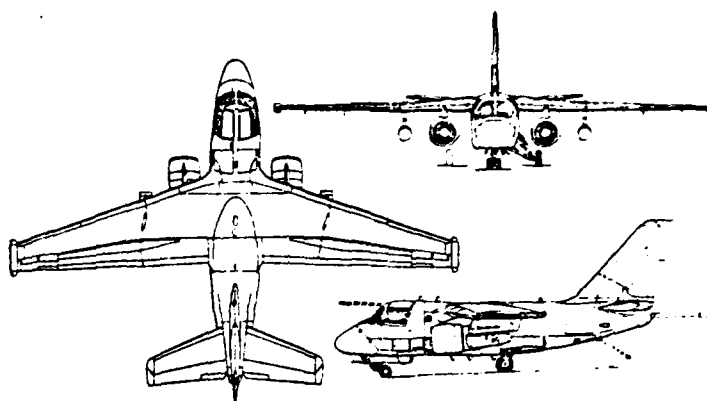
WORK UNIT CODE: 734M2
AIRCRAFT: S3A

1. LOCATION: (Indicate)
LH bay, middle row, RH internal
avionics bay.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL: 1. Loosen equipment panel retainer lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Cockpit
Test Equipment Required: BA-59 (simulates AHRS gyro)
Actions: 1. Select AHRS and accomplish AHRS BIT.
2. Verify operation against BDI and HSI.

8. ANALYST'S COMMENTS: This is another straightforward installation, incorporating a small unit, light weight, convenient height and relatively simple checkout. Organizational level personnel do report that availability of the BA-59 does pose some problems.

NOMENCLATURE: PP-4964()/ASN-84 Power Supply
PHOTO ID NO.: 39

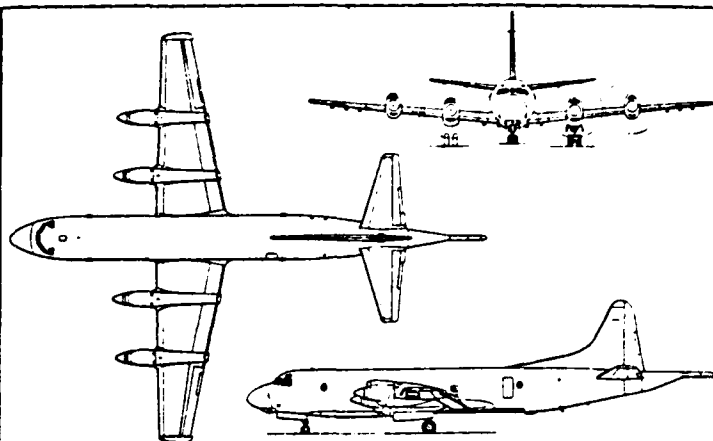
WORK UNIT CODE: 734F6
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics Rack H-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door of rack.

5. REMOVAL: 1. Disconnect 4 electrical connectors.
 2. Loosen 2 knurled knobs.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None
Access Required: Cockpit/NAV-COMM Station.
Test Equipment Required:
Actions: Perform INS operational check.

Power Requirements: ☒ Electric ☐ Hydraulic

8. ANALYST'S COMMENTS: This is a typical installation with outstanding access.

NOMENCLATURE: PP-6188/ASN-92(V). Power Supply
PHOTO ID NO.: 2

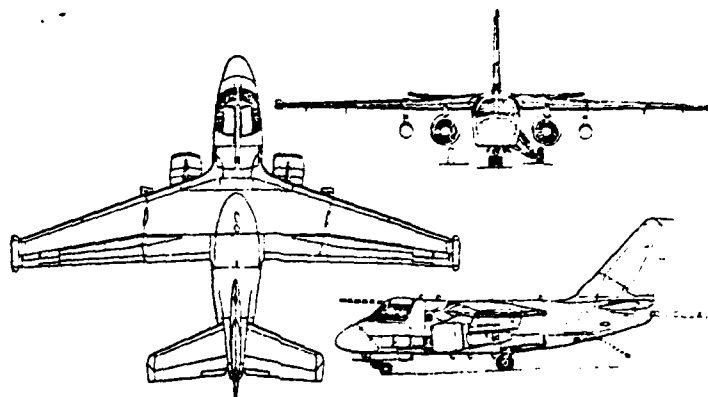
WORK UNIT CODE: 734H2
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
LH bay, bottom row, RH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment

5. REMOVAL: 1. Disconnect 3 twist lock cable connectors.
2. Remove 2 bolts. (Unit is hard mounted to rack.)

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Accomplish AUX-2 Test and BITE Test portions of inertial navigation subsystem functional check.

8. ANALYST'S COMMENTS: Access is good. Control of bolts after removal of unit is a minor inconvenience that could be solved by having captive bolts installed on the unit.

NOMENCLATURE: CP-924/ASN-84 Navigation Computer
PHOTO ID NO.: 40

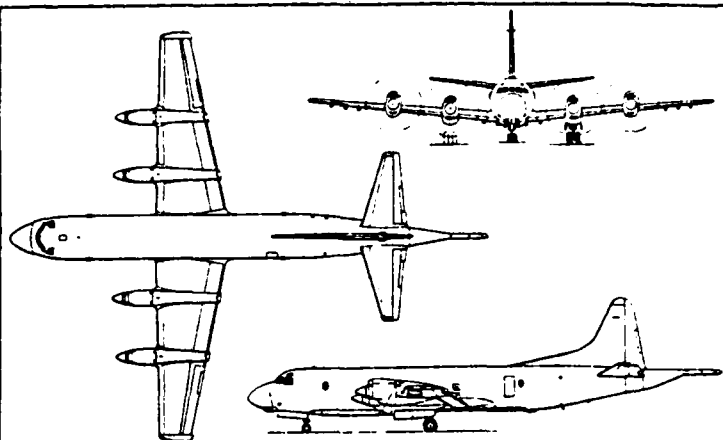
WORK UNIT CODE: 734F7
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronics Rack H-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door to rack.

5. REMOVAL: 1. Remove 5 electrical connectors.
2. Loosen 2 knurled knobs.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit/NAV-COMM Station

Test Equipment Required:

Actions: 1. Enter gyroscope assembly constants.
2. Perform INS operational check.

8. ANALYST'S COMMENTS: This is a good installation, typical of the P-3 aircraft.

NOMENCLATURE: CP-964/ASN-92(V) Air Navigation Computer
PHOTO ID NO.: 1

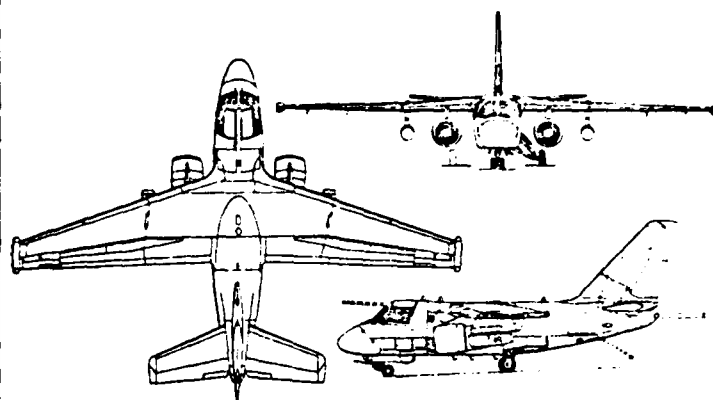
WORK UNIT CODE: 734H3
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
LH bay, bottom row, RH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL: 1. Disconnect 6 twist lock cable connectors.
 2. Loosen 2 knurled knob retainers.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: Perform AUX-2 Test and BITE Test portions of internal navigation subsystem
 functional check.

8. ANALYST'S COMMENTS: As with most of the avionics equipment located in the internal
avionics bay, the installation affords easy access. The front mounted cable connectors
speed removal and replacement--a good installation.

NOMENCLATURE: CN-1263/ASN-92(V) Inertial Measurement Unit
PHOTO ID NO.: 17

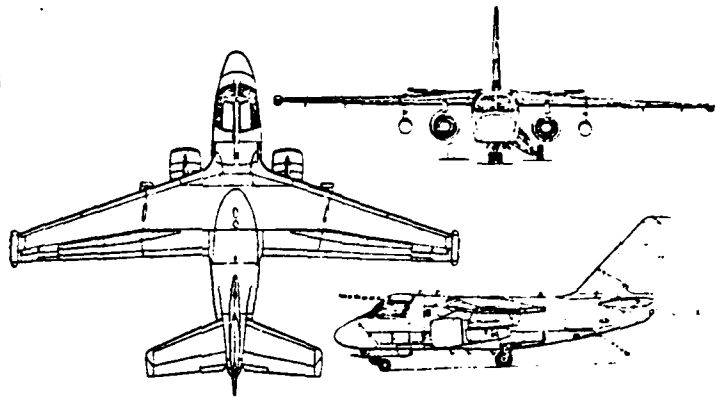
WORK UNIT CODE: 734H1
AIRCRAFT: S3A

1. LOCATION: (Indicate)
LH side, on floor between cockpit
and SENSO stations.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Passageway between cockpit and SENSO/TACCO area.

5. REMOVAL: 1. Remove access panel. Secured with DZUS/Velcro tape.
2. Disconnect 3 twist lock cables.
3. Release air duct (clamped).
4. Remove 2 Allen head mounting bolts.
5. Unit may be removed from front or side.
6. Remove retainer from rear of IMU.

6. INSTALLATION: ☒ Reverse Of Removal Allen head mounting bolts must be torqued in 2 steps:
1. 25 inch-pounds
2. 50 \pm 5 inch-pounds.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Cockpit

Test Equipment Required:

Actions: 1- Perform AUX-2 Test and BITE Test of INS subsystem functional check.

8. ANALYST'S COMMENTS: This is a fair installation due to location and mounting.
Despite the fact that the floating anchor nuts used to engage the mounting bolts are difficult to center. Another irritant noted is that the handle on the front of the unit is not designed for carry.

ECM SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
ALR-47 Countermeasures Receiving Set	N/A	768G1. 768G3.
ALQ-78 Countermeasures Set	76613. 76614	N/A

SYSTEM: ECM

• GENERAL COMMENTS:

Three of the four ECM installations surveyed can be considered good. Minor complaints were voiced concerning the number of connectors, waveguides, and seating of rack and panel connectors, but the physical installations were simple and straightforward. The exception to this judgment was the ALR-47 Countermeasure Receiver, R-1742, located in the wing tip pods of the S-3A. This installation was considered deficient for a variety of reasons, enumerated as follows:

1. The LH wing tip pod is inaccessible when wings are folded.
2. Removal and replacement of the receiver, within the pod, must be accomplished at Intermediate level.
3. Removal of the pod necessitates disrupting another aircraft system which in turn, requires an operational check after pod re-installation.
4. Ten high-torque screws, which must be removed to gain access to the electrical connectors, are used in the panel.
5. The receiver can be mounted upside down within the pod.

Some of the problems can be attributed to the original design of the receiver and the need to locate the unit near the antenna. However, many of the maintenance obstacles could have been avoided by locating the receiver in the wing tip (inboard of the pod) and providing an access panel so that removal and replacement could be accomplished at Organizational level. Sweeping of the antenna and coax after installation could become part of the functional check, without using a sweep cart, by the addition of a sweep generator unit in the system. This would increase aircraft availability by decreasing the required maintenance time.

NOMENCLATURE: CM-416/ALR-47 Signal Comparator
PHOTO ID NO.: 8

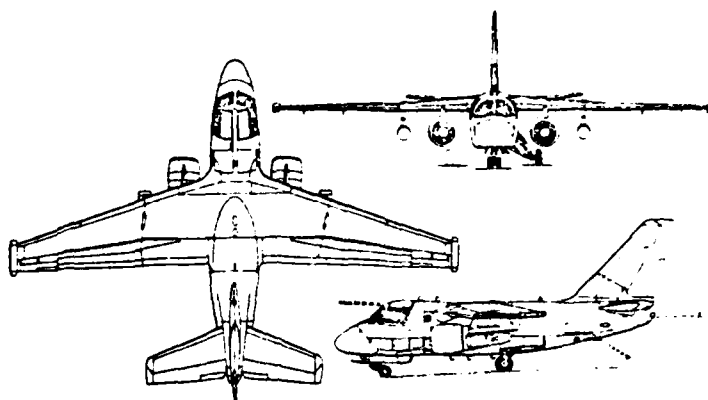
WORK UNIT CODE: 768G1
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
RH bay, middle row, RH internal
avionics rack

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment

5. REMOVAL: 1. Loosen equipment panel retainer lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None

Power Requirements: ☒ Electric ☐ Hydraulic

Access Required: Tacco/Senso Stations

Test Equipment Required: Antenna horns.

Actions: 1. Check diagnostic and operational programs using on-board computer.

8. ANALYST'S COMMENTS: Other than organizational level complaints that the connectors are easily damaged during installation of the unit, this is an excellent installation. The complaint about the connectors could be cured by either beefing up the connector side walls or by re-inforcing the rear wall of the rack, to which the connectors are affixed, to reduce flexing of the connector mounting base.

NOMENCLATURE: R-1742/ALR-47 Countermeasure Receiver
PHOTO ID NO.: 19

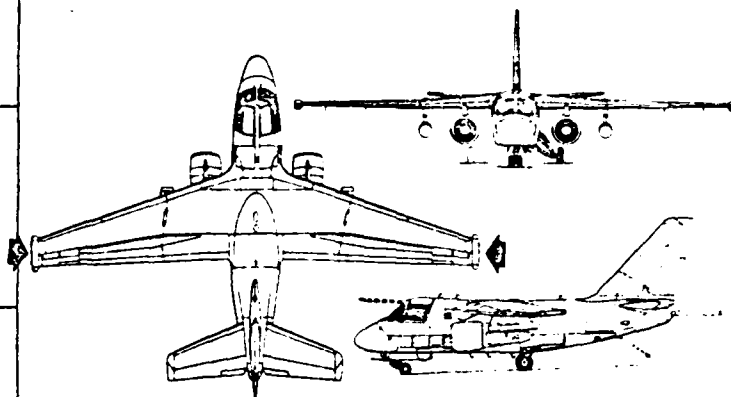
WORK UNIT CODE: 76833
AIRCRAFT: S-3A

1. LOCATION (Indicate)
LH and RH wing tip (pod).

2. SUPPORT EQUIPMENT:

☐ None ☐ Hoist/Sling
☒ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Remove one panel (10 high-torque screws)

5. REMOVAL: 1. Disconnect 4 electrical connectors.
2. Remove 4 bolts securing pod to wing tip.
3. Remove pod and send to Intermediate level shop.

6. INSTALLATION: ☒ Reverse Of Removal
Sealing compound must be applied prior to mating pod to wing tip.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: TACCO Station
Test Equipment Required:
Actions: 1. Accomplish ECM wing tip pod assembly functional check.
2. Perform Wing Position Light operational check.

8. ANALYST'S COMMENTS: Use of high-torque screws, the "breaking" of another system, and the need to send the entire pod to an Intermediate level shop to remove and replace the receiver make this installation completely unsatisfactory. Additionally, with wings folded, the left wing tip pod removal and replacement pose serious access problems for maintenance due to height of the pod. Use of a clevis bolt and latch or modular (R-1742) removal technique would have improved the maintainability aspects of this installation considerably, but would not solve the problems created by location. A secondary aspect is the fact that the receiver can be installed in the pod in an inverted position, (at I level).

NOMENCLATURE: CV-2776/ALQ-78 RF Converter
PHOTO ID NO.: 50

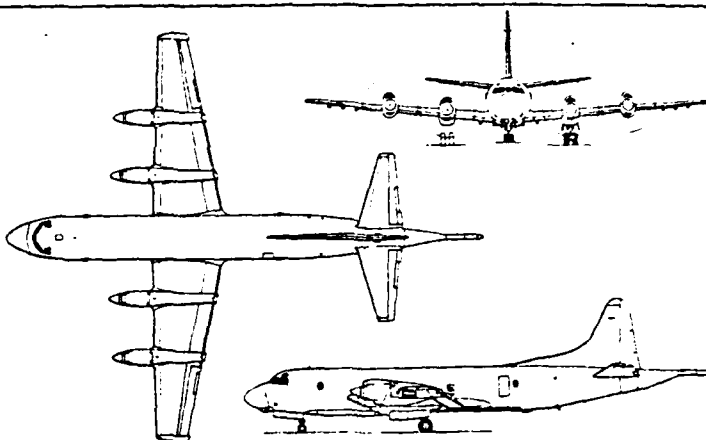
WORK UNIT CODE: 76613
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronic Rack G-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Remove lower RH side aisle panel (11 DZUS fasteners). Open door to rack. (Unit is side mounted with front access facing aisle panel.)

5. REMOVAL: 1. Disconnect 5 coax cables and 3 electrical connectors.
2. Disconnect 3 waveguides from converter. (4 screws each)
3. Loosen 2 knurled knobs.
4. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None
Access Required: Sensor station 3.
Test Equipment Required:

Power Requirements: ☒ Electric ☐ Hydraulic

Actions: 1. Accomplish operational check.

8. ANALYST'S COMMENTS: Access to waveguides and cables is difficult at best due to size, quantity, and location. In practice, the unit is frequently removed through the rack door access.

NOMENCLATURE: O-1590/ALQ-78 Video-Local Oscillator
PHOTO ID NO.: 49

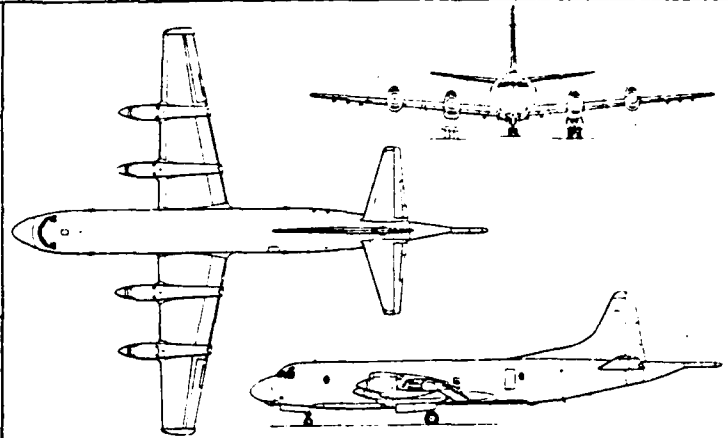
WORK UNIT CODE: 76614
AIRCRAFT: P-3C

1. LOCATION: (Indicate)
Electronic rack G-1

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Open door to rack.

5. REMOVAL: 1. Disconnect 1 pip cable, 3 coax cables, 4 electrical connectors and 1 ground connection.
 2. Loosen 2 knurled knobs.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: Sensor station 3
Test Equipment Required:
Actions: 1. Accomplish operational check.

8. ANALYST'S COMMENTS: The number of cables detract from an otherwise clean installation.
The amount of slack on the cables is noteworthy.

PHOTOGRAPHIC RECONNAISSANCE SYSTEMS

CONTENTS/WORK UNIT CODES

<u>COMPONENT</u>	<u>P-3</u>	<u>S-3</u>
Infrared Detecting Group	N/A	77311 77313 77314

SYSTEM: PHOTOGRAPHIC RECONNAISSANCE

• GENERAL COMMENTS:

Three units of the Infrared Detecting Group were surveyed under this category. The C-8759, IR Control Converter, and the PP-6611, Video Converter Power Supply, installations were good with more than adequate access and utilizing rack and panel connectors and equipment lock lugs. This was not true of the third item surveyed. The Infrared Viewer, IP-1069, is the most dreaded remove and replace avionic action on the aircraft. The technicians often replace other components in the system, sometimes more than once, rather than accept the obvious fact that the viewer is at fault and must be changed. The prime complaint concerning the lack of accessibility is justified, and yet, it appears to be the area in which some immediate and relatively inexpensive relief could be provided.

Access is now restricted to the front of the installation (when facing the FLIR access door). The primary need is for a small access in the rear. Since the rear of the FLIR compartment abuts on the nose landing gear sidewalls, accessibility for an access panel entering to the rear of the FLIR compartment is a practicality. Some re-routing of lines may be required, but the sidewall in question is relatively free of obstruction. The effect on the structural integrity of the wall, if an access panel becomes a serious consideration, must be determined.

NOMENCLATURE: IP-1069()/AA Infrared Viewer
PHOTO ID NO.: 18

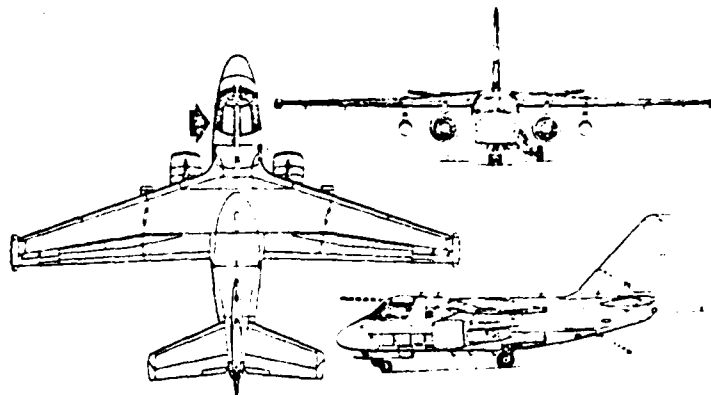
WORK UNIT CODE: 77322
AIRCRAFT: S3A

1. LOCATION: (Indicate)
FLIR Compartment, FWD LH side.

2. SUPPORT EQUIPMENT:

☐ None ☒ Hoist/Sling - both
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
☒ Electric Sensor Dolly and
☐ Hydraulic Adapter.

3. PREPARATION: ☒ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Open FLIR access door.

5. REMOVAL: 1. Extend viewer, then retract slightly.
2. Disconnect actuator arm from nose gear door.
3. Disconnect FLIR door from cable brackets noting location of different size screws.
4. Remove 5 electrical connectors.
5. Attach hoist adapter to overhead structure of FLIR compartment.
(see continuation sheet)

6. INSTALLATION: ☒ Reverse Of Removal

NOTE: Install new cotter pin when connecting actuator arm to nose gear door.

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: TACCO/SENSO/Copilot Stations
Test Equipment Required:
Actions: 1. Service Viewer with Helium.
2. Accomplish optical cleaning procedure.
3. Perform downstop lug adjustment.
4. Perform proximity switch adjustment.
5. Accomplish FLIR subsystem functional check.

8. ANALYST'S COMMENTS: This is an unsatisfactory installation. Maintenance personnel, (one of whom must climb up over the unit to accomplish steps in the removal action), discussed the lack of access, the need for three people, the fact that on the newer, modified installations the bolts in the rear are "extremely difficult" to reach, that if the actuator fails the shorting plug is near impossible to connect, and that the brakes on the turret are a constant problem. Other problems dealt with reliability of the unit and the installation (five sets of door tracks were broken on the Cruise), and the abject lack of maintainability features.

NOMENCLATURE: IP-1069()/AA Infrared Viewer

WUC: 77311

AIRCRAFT: S-3A

5. REMOVAL: (Continued)

6. Attach sensor sling hooks to viewer mounting bracket.
7. Insert bomb hoist into FLIR compartment and engage hoist bearing pin to adapter.
8. Position sensor dolly.
9. Attach hoist cable to sling and remove slack.
10. Raise Viewer slightly.
11. Remove chain drive bracket pins.
12. Install Viewer shroud.
13. Hand guide viewer through opening, insuring that viewer clears FLIR door.
14. Lower Viewer onto dolly.
15. Remove pivot bolt bushings.
16. Remove hoist cable from sling, hoist from aircraft and sling from viewer.
17. Install FLIR door to bracket with screws removed in step 3. Insure screws are installed in same location from which they were removed.
18. Remove hoist adapter.
19. Reconnect nose gear door and FLIR door.
20. Connect P382 connector to dummy receptacle.
21. Drive elevation axis to stowed position.
22. Close FLIR access door.

NOMENCLATURE: C-8759()/AA Infrared Control Converter
PHOTO ID NO.: 11

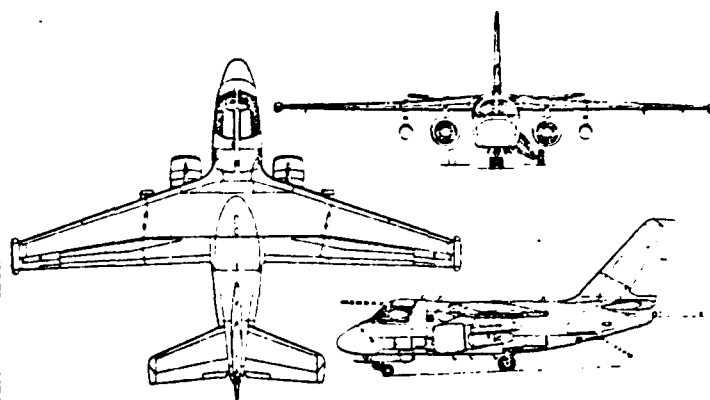
WORK UNIT CODE: 77313
AIRCRAFT: S-3A

1. LOCATION: (Indicate)
RH bay, top row, LH internal avionics
rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
Power (Type) ☐ Service (Type)
 ☐ Electric
 ☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
 ☐ Fuel/Defuel ☐ Jack Aircraft
 ☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment.

5. REMOVAL: 1. Loosen equipment panel lock lugs.
 2. Disengage rack and panel connectors.
 3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
 ☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: TACCO/SENSO/Co-Pilot stations
Test Equipment Required:
Actions: 1. Perform the FLIR subsystem functional check.

8. ANALYST'S COMMENTS: This is a good installation.

NOMENCLATURE: PP-6611()/AA Video Converter Power Supply
PHOTO ID NO.: 10

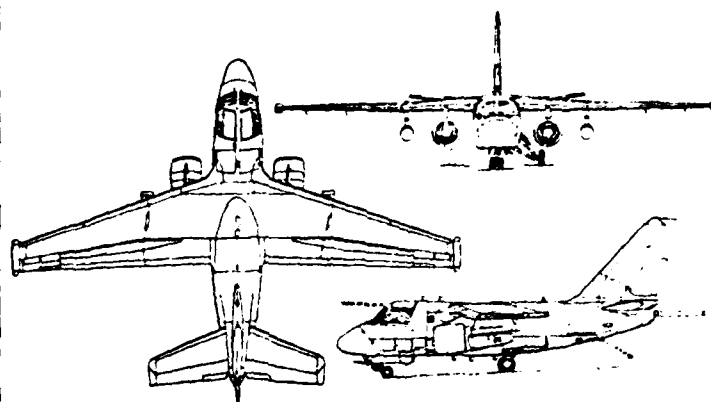
WORK UNIT CODE: 77314
AIRCRAFT: S3A

1. LOCATION: (Indicate)
RH bay, top row, LH internal
avionics rack.

2. SUPPORT EQUIPMENT:

☒ None ☐ Hoist/Sling
☐ Workstand ☐ Jacks
☐ Power (Type) ☐ Service (Type)
☐ Electric
☐ Hydraulic

3. PREPARATION: ☐ Safety Steps
☐ Fuel/Defuel ☐ Jack Aircraft
☐ Other (Specify):



4. ACCESS/CLOSE UP: Internal Avionics Compartment

5. REMOVAL: 1. Loosen equipment panel lock lugs.
2. Disengage rack and panel connectors.
3. Remove unit.

6. INSTALLATION: ☒ Reverse Of Removal

After Installation Actions: ☐ Bleed ☐ Rig ☐ Adjust ☐ Service ☐ Lubricate
☐ Boresight ☐ Other (Specify):

7. FUNCTIONAL CHECK: ☐ None Power Requirements: ☒ Electric ☐ Hydraulic
Access Required: TACCO/SENSO/Co-Pilots station
Test Equipment Required:
Actions: 1. Accomplish FLIR subsystem functional check

8. ANALYST'S COMMENTS: This is a good installation with no problems.

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